



Report  
Appendices S through W  
60251

~~Volume 2 of 3~~  
Remedial Investigation Report  
Baseline Risk Assessment  
ACS NPL Site  
Griffith, Indiana

Prepared for:  
Steering Committee  
ACS PRP Group

Prepared by:  
Warzyn Inc.  
Madison, Wisconsin

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**Appendix S**  
**Identification of Chemicals**  
**of Potential Concern**

## **Appendix S**

### **IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN**

Chemicals of potential concern to be considered in the Baseline Risk Assessment are those which are present as a result of chemical releases which have occurred at the Site. To identify these, chemicals present in soil and groundwater samples are distinguished from those which may be naturally present and those which may be unintentionally introduced into samples through sample collection or laboratory analysis.

#### **CHEMICAL ANALYSES OF SITE MEDIA**

A detailed characterization of contaminants identified at the Site is presented in the RI report, including a description of the number and location of soil, groundwater, surface water, and sediment samples collected (RI Report Section 2) and a discussion of the results of chemical analyses of the samples (RI Report Section 5). The results of these analyses are presented in Appendix R.

The chemical analyses of samples were performed by CLP laboratories. The analytical data generated has been evaluated as to usability in accordance with U.S. EPA guidelines for validation of organic and inorganic analyses of environmental samples (EPA 1988a and b). Data used in risk assessment include both unqualified data and data which represent estimated quantities (qualified as J). A description of the evaluation of data quality is presented in Appendix Q.

Three general contaminant source areas were identified during the investigation. The physical characteristics and contaminants present in each of these areas differs. For the purpose of the risk assessment, discrete areas within the Site have been designated as follows:

- On-Site Containment Area
- Still Bottoms/Treatment Lagoon Area
- Off-Site Containment Area
- Kapica-Pazmey Area
- Groundwaters
- Surface waters and Sediments

Groundwater samples have been further divided into upper and lower aquifer samples. Soil samples from Kapica-Pazmey have been separated into surface (0-3 ft) and sub-surface groups. Sample descriptions for each area are presented in table 7-1. Recall that not all samples had full TAL and TCL analyses.

### DEVELOPMENT OF A CHEMICAL DATA SET AND INFORMATION FOR USE IN THE RISK ASSESSMENT

The following describes the rationale for selection or exclusion of identified chemicals in the data set as chemicals of potential concern for further evaluation in the risk assessment. Which samples to include in the exposure concentration estimate for each chemical is determined. The process of identifying chemicals of potential concern and which samples to include is an integrated procedure. Most of the rationale used to identify chemicals of concern is also used to identify the samples included.

Chemicals that exhibit the following are included in the quantitative risk assessment:

- Positively detected in at least one sample from a given discrete area.
- Determined to be present at the Site and not due to contamination introduced during sampling or analysis.
- Determined to be the result of chemical releases from the Site and not natural background levels.
- Tentatively identified compounds associated with the site.
- Transformation products of chemicals demonstrated to be present.

Positively detected chemicals include both unqualified results and results qualified as estimated but with known identities ( J qualified Target Compound List data).

Each chemical of potential concern is usually not detected in all samples from a Site area. Samples where a chemical is not detected are evaluated to determine the proxy concentration most representative of potential exposures at the Site area. Given the complexity of the Site, if a compound was detected in at least one sample from an area, it is reasonable to believe the chemical may be present below the detection limit in the non-detect samples. A value of one-half the non-detect Sample Quantitation Limit (SQL) is used as a proxy concentration to estimate exposure concentration. For samples requiring dilutions due to high levels of some organic chemicals, non-detect chemicals will have elevated SQLs. In this case, the proxy concentration would cause a high bias if included in the exposure concentration. If the maximum detected concentration in an area for a given medium is less than the one-half SQL proxy concentration, then the sample is eliminated from consideration in the exposure concentration estimate for that chemical.

Some analytical results may not be representative of Site conditions. Potential contamination during sampling and analysis is monitored through the use of field and laboratory blanks carried through the analysis. Chemical concentrations determined to be the result of contamination are qualified during data validation, generally by raising the SQL of the affected samples above that of the blank contamination. On occasion, common laboratory contaminants will not be qualified during validation, when the contaminant was present in a sample, but not the blank. These are usually acetone, methylene chloride, 2-butanone or phthalates found infrequently near the SQL. These have been discussed on a site by site basis below.

If inorganic chemicals were present at the Site area at naturally occurring background levels, they were eliminated from further consideration in the risk assessment. No background samples were taken at the site. Results from background samples collected in July, 1987 from the Ninth Avenue Dump Site, approximately ten miles north of the ACS Site, were used to determine naturally occurring background levels, as presented in table S-1 of this Appendix. For each metal, the arithmetic mean of the concentration of ten background samples was assumed to represent background concentrations. If a metal was not positively detected, the average common range as presented in U.S. EPA

Office of Solid Waste and Emergency Response, Hazardous Waste Land Treatment, SW-874 (April,1983) Page 273, Table 6.46, was used. If there is no reported common range, the average of the detection limits from the Ninth Avenue Dump background samples was used. If the arithmetic mean of the concentrations from each source area was less than this background concentration, the metal was eliminated from further consideration as a Chemical of Potential Concern for the Source Area, as summarized in Table S-2 of this Appendix.

Averaged results for both rounds of sampling from background wells GWMW11 for upper aquifer water samples and GWMW07 for lower aquifer water samples were used to evaluate groundwater samples, as summarized in table S-3 of this Appendix. No background levels were available for surface waters; all chemicals detected in surface water samples are included as chemicals of potential concern.

Over 450 Tentatively Identified Compounds (TICs) were reported for the Site. TICs were grouped as discussed in Section 7.1.2.2. The maximum concentration of any of the detected compounds within a TIC group for each source area was carried forward as the Exposure Point Concentration.

Transformation products of chemicals present in each area were considered for inclusion in the risk assessment. Volatile chlorinated ethane and ethene transformation sequences are present in most areas.

A large number of compounds were detected in samples from the Site areas. The following discussion summarizes the evaluation of identified analytes as chemicals of potential concern.

#### ACS GROUNDWATERS -UPPER AQUIFER

Twenty-four samples were taken from the upper groundwater aquifer. Chemical concentrations ranged from 2 to 200,000 ug/L. 17 volatiles, 18 semi-volatiles, 2 PCBs, and 15 inorganic analytes were detected in these samples.

Of the chemicals detected in at least one sample, methylene chloride is the only chemical to be dropped as a chemical of potential concern due to blank contamination. Methylene chloride was qualified during data validation as undetected (U) due to blank contamination in all but two samples. These two samples, at 1 and 7 ug/L, are less than other qualified results, and are likely due to laboratory contamination also, though not strictly fitting the validation criteria for qualifying the results.

#### ACS GROUNDWATERS - LOWER AQUIFER

Four monitoring wells were screened in the lower aquifer. Relatively few analytes were detected in the samples. Chloroethane and 4-methyl-2-pentanone for the volatiles, and bis(2-chloroethyl)ether for the semi-volatiles are the only organic chemicals detected.

Methylene chloride is present at 3, 8, and 14 ug/L in these samples, within levels found in blanks run one day before and after sample analysis, and as such, are likely the result of lab contamination.

#### ACS SURFACE WATERS

Five surface water samples were collected. Chemicals detected include 10 volatiles, 9 semi-volatiles, and one PCB. Seventeen of the 23 metals were detected.

No background surface water was available near the site. All detected analytes are to be carried through the risk assessment.

#### ACS SEDIMENTS

The eighteen sediment samples analyzed contained 10 volatiles, 26 semi-volatiles, 1 pesticide and three PCBs, as well as 20 of the 23 metals.

Methylene chloride was detected in 14 of the samples at concentrations of 13 to 120 ug/kg, and was qualified as blank contamination in 13 of the samples. The remaining sample at 44 ug/kg, is most likely also the result of laboratory blank contamination. Chloroform, also a common laboratory contaminant, was present in 8 samples at 2-8 ug/kg, and was qualified as blank contamination in two samples. The remaining samples, with concentrations of 2-8 ug/kg, are likely also the result of contamination. Both methylene chloride and chloroform are eliminated from further consideration.

#### ON SITE CONTAINMENT AREA

Forty three soil and test pit samples were analyzed from the On Site containment area. Detected chemicals include 20 volatiles, 27 semi-volatiles, 2 pesticides and 3 PCBs, as well as 20 metals and cyanide.

Methylene chloride detects were determined to be the result of laboratory contamination, and were qualified as non-detected during data validation. No other TCL analytes were eliminated from consideration due to blanks.

#### STILL BOTTOMS & TREATMENT LAGOON

The twenty-nine soil and test pit samples collected contained 20 volatiles, 45 semi-volatiles, 4 pesticides and 3 PCBs, and all 24 TAL parameters.

No chemicals were eliminated from consideration due to blank contamination, although some individual sample results were qualified during validation.

#### OFF SITE CONTAINMENT AREA

Forty three soil samples and one waste were analyzed. A total of 24 volatiles, 42 semi-volatiles, 7 pesticides and 4 PCBs, and all 24 TAL parameters were detected in these samples.

No chemicals of potential concern were eliminated due to blank contamination.

#### KAPICA-PAZMEY AREA - SURFACE SOILS

Sixteen soil and test pit samples were collected and analyzed for at least one of the four CLP analyses. In those analyses 16 volatiles, 32 semi-volatiles, 2 pesticides and 4 PCBs, and 23 inorganic parameters were detected.

No chemicals were eliminated due to blank contamination.

KAPICA-PAZMEY - SUB SURFACE SOILS

Sixteen soil and test pit samples were collected and analyzed for at least one of the four CLP analyses. In those analyses 20 volatiles, 31 semi-volatiles, 3 PCBs, and 23 inorganic parameters were detected.

No chemicals were eliminated due to blank contamination.

JAH/jah/ccf/KJD/BJC  
[ccf-600-97j]  
60251.17-MD

Table S-1

Determination of Metals Background Concentrations  
Used in Determination of Chemicals of Potential Concern

SAMPLE ID: SAMPLE DATE:	SX60	SX61	SX62	SX63	SX64	SX65	SX66	SX67	SX68	SX69	----- Statistical Analysis -----					SOIL BACKGROUND CONC. (mg/kg)
	7/9/87	7/9/87	7/9/87	7/9/87	7/9/87	7/9/87	7/9/87	7/9/87	7/9/87	7/9/87	MIN	MAX	AVE	n	STD	a
Results in mg/kg																
Aluminum	16800	4700	7520	11200	4170	3880	5400	3920	5200	7840	3880	16,800	7063	10	4,122	7.06e+03
Antimony	No Detects															9.70e+00
Arsenic	21.3	12.1	10.6	14.9	6.3	8	5.5	7.3	7.9	15.8	5.5	21.3	10.97	10	5.06	1.10e+01
Barium	126	37	72.5	67	60.2	39.3	100	52	50.5	117	37	126	72.15	10	31.70	7.22e+01
Beryllium	No Detects															6.00e+00
Cadmium	3.4	2.1	1.4	2.8	3	1.8	3.5	2.7	2.1	3.6	1.4	3.6	2.64	10	0.76	2.64e+00
Calcium	6970	4380	5710	5950	3820	5630	10300	7280	15100	17100	3820	17,100	8224	10	4,537	8.22e+03
Chromium, total	24	12.8	18.5	20	17.2	12.1	21.7	11.2	10.5	30.2	10.5	30.2	17.82	10	6.39	1.78e+01
Cobalt	7.7	3.4	4.1	6.2	2.9	2.8	3.2	2.8	4	3.8	2.8	7.7	4.09	10	1.62	4.09e+00
Copper	28.9	24	22.6	26	29	24.7	42	26.9	13.5	29.4	13.5	42	26.7	10	7.11	2.67e+01
Iron	20400	10400	9820	17300	9190	6480	15000	15300	11600	13700	6480	20,400	12,919	10	4,201	1.29e+04
Lead	42	66	64	55.9	194	134	291	190	16.2	117	16.2	291	117.01	10	86.12	1.17e+02
Magnesium	3380	1840	2980	3340	1060	1460	3000	1730	2890	2460	1060	3380	2414	10	831.59	2.41e+03
Manganese	No Detects															6.00e+02
Mercury		0.34		0.55	0.26	0.13		0.34			0.13	0.55	0.324	5	0.15	3.24e-01
Nickel	30.6	11.5	14	20	25	5.8	15.2	12	10.1	15.6	5.8	30.6	15.98	10	7.38	1.60e+01
Potassium	2190	677	786	1450	439	315	356	410	659	803	315	2190	808.5	10	587.26	8.09e+02
Selenium	No Detects															3.00e-01
Silver	No Detects															5.00e-02
Sodium	No Detects															6.30e+03
Thallium	No Detects															2.30e+00
Vanadium	34	17	21	26.1	9.8	15.5	25.3	10.3	11.4	19	9.8	34	18.94	10	7.84	1.89e+01
Zinc	121	288	269	155	330	283	608	360	69.3	292	69.3	608	277.53	10	149.84	2.78e+02
Cyanide, total	No Detects															3.70e+00

a = Background soil analytical results from samples collected July 1987 are reported in the "Remedial Investigation Report - Ninth Avenue Dump RI/FS Gary, Indiana (June 1988)"

b = Background levels for compounds without positive detected concentrations are footnoted as follows:  
Background value is the average concentration of natural soils as presented in U.S. EPA Office of Solid Waste and Emergency Response, Hazardous Waste Land Treatment, SW-874 (April, 1983) Page 273, Table 6.46

c = No values for natural soils available. Reported background concentration is the average of the calculated sample detection limits.

Table S-2

Background Values Used to Eliminate Chemicals  
From Consideration as Chemicals of Potential Concern

CHEMICAL	UNITS	SOILS BACKGROUND <sup>a</sup>		SOILS AVERAGE CONCENTRATIONS <sup>b</sup>				SEDIMENT
		AVE	SB-TL AVE	ONSITE AVE	OFFSITE AVE	KP-SUB AVE	KP-SURFACE AVE	
Aluminum	mg/kg	7.1e+03	3.6e+03 < Bkgd	3.2e+03 < Bkgd	4.5e+03 < Bkgd	3.4e+03 < Bkgd	7.7e+03	6.7e+03 < Bkgd
Antimony	mg/kg	9.7e+00	2.9e+01	5.3e+00 < Bkgd	4.6e+01	1.1e+01	5.0e+01	4.0e+00 < Bkgd
Arsenic	mg/kg	1.1e+01	2.4e+00 < Bkgd	3.7e+00 < Bkgd	3.3e+00 < Bkgd	2.0e+00 < Bkgd	1.0e+01 < Bkgd	7.0e+00 < Bkgd
Barium	mg/kg	7.2e+01	4.7e+02	5.2e+02	1.5e+03	1.5e+03	2.5e+03	7.9e+01
Beryllium	mg/kg	6.0e+00	2.5e-01 < Bkgd	1.6e-01 < Bkgd	2.1e-01 < Bkgd	1.5e-01 < Bkgd	5.3e-01 < Bkgd	4.6e-01 < Bkgd
Cadmium	mg/kg	2.6e+00	1.5e+01	7.2e-01 < Bkgd	1.0e+02	1.0e+01	1.1e+02	1.0e+00 < Bkgd
Calcium	mg/kg	8.2e+03	1.1e+04	8.8e+03	1.9e+04	3.5e+03 < Bkgd	5.0e+04	1.6e+04
Chromium, Total	mg/kg	1.8e+01	2.0e+02	3.2e+01	2.5e+02	2.6e+02	1.3e+03	3.1e+01
Cobalt	mg/kg	4.1e+00	4.2e+01	2.2e+01	3.0e+01	1.2e+01	8.2e+01	
Copper	mg/kg	2.7e+01	7.3e+01	2.2e+01 < Bkgd	4.2e+02	4.8e+02	1.6e+03	4.8e+01
Iron	mg/kg	1.3e+04	3.9e+03 < Bkgd	5.3e+03 < Bkgd	8.2e+03 < Bkgd	4.3e+03 < Bkgd	2.5e+04	1.2e+04 < Bkgd
Lead	mg/kg	1.2e+02	8.4e+02	1.1e+02 < Bkgd	1.1e+03	1.0e+03	8.3e+03	1.0e+02 < Bkgd
Magnesium	mg/kg	2.4e+03	3.4e+03	4.4e+03	8.3e+03	2.9e+03	1.6e+04	5.8e+03
Manganese	mg/kg	6.0e+02	2.0e+02 < Bkgd	1.5e+02 < Bkgd	1.4e+02 < Bkgd	5.8e+01 < Bkgd	6.7e+02	1.7e+02 < Bkgd
Mercury	mg/kg	3.2e-01	2.0e+00	1.2e+01	5.2e+00	1.2e+00	7.0e+00	2.1e+00
Nickel	mg/kg	1.6e+01	1.7e+01	1.2e+01 < Bkgd	3.4e+01	1.3e+01 < Bkgd	7.1e+01	2.5e+01
Potassium	mg/kg	8.1e+02	3.5e+02 < Bkgd	4.8e+02 < Bkgd	1.1e+03	3.1e+02 < Bkgd	7.1e+02 < Bkgd	7.2e+02 < Bkgd
Selenium	mg/kg	3.0e-01	1.4e+00	4.5e-01	3.4e+01	1.5e+00	8.4e+00	1.0e+00
Silver	mg/kg	5.0e-02			3.1e+02	6.4e+01	2.5e+01	
Sodium	mg/kg	6.3e+03	7.6e+02 < Bkgd		7.0e+02 < Bkgd	2.1e+02 < Bkgd	1.4e+03 < Bkgd	
Thallium	mg/kg	2.3e+00			1.1e+00 < Bkgd			1.4e+00 < Bkgd
Vanadium	mg/kg	1.9e+01	7.4e+00 < Bkgd	1.1e+01 < Bkgd	1.1e+01 < Bkgd	7.5e+00 < Bkgd	2.4e+01	2.1e+01
Zinc	mg/kg	2.8e+02	3.6e+02	7.2e+01 < Bkgd	4.6e+02	6.5e+02	8.7e+03	1.1e+02 < Bkgd
Cyanide, Total	mg/kg	3.7e+00	2.7e+01	8.7e+00	1.4e+01	2.1e+01	3.5e+01	

a = Background values are average concentration from 9th Ave. Dump Site Background samples.

b = Source Area values are arithmetic mean of all detected concentrations.

c = No data from Ninth Ave Dump; background value is average from EPA common range.

d = No EPA common range available; Not detected at Ninth Ave. Dump. Background value is average of detection limits from Ninth Ave. Dump.

<Bkgd = Average concentration for Source Area is less than background; the chemical is eliminated from further consideration as a Chemical of Potential Concern.

Table S-3

Background Values Used to Eliminate Chemicals  
From Consideration as Chemicals of Potential Concern

CHEMICAL		Upper Aquifer		Lower Aquifer		Surface Waters		
		<sup>a</sup>	<sup>d</sup>	<sup>b</sup>	<sup>d</sup>	<sup>c</sup>	<sup>d</sup>	
		Bckgrd	Results	Bckgrd.	Results	Bckgrd.	Results	
		Ave.	Ave.	Ave.	Ave.	Ave.	Ave.	
Aluminum	ug/l	2.7e+02	2.7e+02				7.3e+02	NA
Antimony	ug/l							NA
Arsenic	ug/l		1.4e+01	2.4e+00	4.1e+00		2.4e+01	NA
Barium	ug/l		6.1e+02		2.6e+02		3.3e+02	NA
Beryllium	ug/l		2.5e-01				2.8e-01	NA
Cadmium	ug/l	3.2e-01	9.8e-01				5.5e-01	NA
Calcium	ug/l	5.1e+04	1.8e+05	5.7e+04	1.1e+05		1.1e+05	NA
Chromium, Total	ug/l		2.4e+00				1.2e+01	NA
Cobalt	ug/l							NA
Copper	ug/l			2.0e+01			2.2e+01	NA
Iron	ug/l	5.5e+02	2.5e+04	1.5e+02	1.0e+03		5.0e+03	NA
Lead	ug/l		3.9e+00				1.1e+01	NA
Magnesium	ug/l	1.8e+04	3.4e+04	1.5e+04	3.6e+04		2.5e+04	NA
Manganese	ug/l	3.1e+02	2.1e+03	1.0e+02	3.4e+02		7.7e+02	NA
Mercury	ug/l		1.7e+00		4.7e-01			NA
Nickel	ug/l		5.0e+01				6.8e+01	NA
Potassium	ug/l	1.2e+03	1.4e+04	1.1e+03	1.9e+03		1.3e+04	NA
Selenium	ug/l		3.5e+00				2.1e+00	NA
Silver	ug/l							NA
Sodium	ug/l	4.8e+03	1.5e+05	1.3e+04	4.1e+04		5.5e+04	NA
Thallium	ug/l		3.6e+00					NA
Vanadium	ug/l	2.0e+00	8.3e+00	2.4e+00	2.0e+00			NA
Zinc	ug/l	4.2e+01	1.1e+02		1.6e+01		6.4e+01	NA
Cyanide, Total	ug/l		1.0e+01					NA

a = Background values are taken GMMW11 for Upper Aquifer Groundwater samples

b = Background values are taken GMMW07 for Lower Aquifer Groundwater samples

c = No background values available for surface waters

d = Source Area values are arithmetic mean of all detected concentrations.

< Bkgd = Average concentration for Source Area is less than background; the chemical is eliminated from further consideration as a Chemical of Potential Concern.

**Appendix T**  
**Equations Used to Estimate**  
**Chronic Daily Chemical Intakes**

## Appendix T

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<u>Land Use Scenario</u>	<u>Exposed Population</u>	<u>Exposure Medium</u>	<u>Route of Intake</u>	<u>Table Number</u>
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**Table T-1**

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Adult off-Site resident
- Ingestion of groundwater (lower aquifer only)

$$\text{Intake (mg/kg-day)} = \frac{\text{CW} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CW = Contaminant concentration in water (mg/L)

IR = Ingestion rate (L/day)

EF = Exposure frequency (day/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

IR - 2 L/day (U.S. EPA, 1989)

EF - 365 days/year (by convention)

ED - 30 years (national upper-bound time at one residence; U.S. EPA, 1989)

BW - 70 kg (U.S. EPA, 1989)

AT - 10,950 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

Table T-2

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Adult off-Site resident
- Dermal absorption of chemicals in water (lower aquifer only) while bathing

$$\text{Absorbed Dose (mg/kg-day)} = \frac{\text{CW} \times \text{SA} \times \text{PC} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{CF} \times \text{AV}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/L)

SA = Skin surface area available for contact (cm<sup>2</sup>)

PC = Chemical-specific dermal permeability constant (cm/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (day/year)

ED = Exposure duration (years)

CF = Volumetric conversion factor for water (L/cm<sup>3</sup>)

AV = Adjustment for contaminants released via volatilization (unitless)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

SA - 19,400 cm<sup>2</sup>; 50th percentile value for male adult - total body surface area (U.S. EPA, 1989)

PC - Chemical-specific (Table 7-17)

ET - 0.2 hrs/day (U.S. EPA, 1989)

EF - 365 days/year (by convention)

ED - 30 years (national upper-bound time at one residence; U.S. EPA, 1989)

CF - 1L/1000 cm<sup>3</sup>

AV - Volatiles - 90% volatilized, 10% available for absorption; semi-volatiles - 50% volatilized, 50% available for absorption (see Appendix Y).

BW - 70 kg; (U.S. EPA, 1989)

AT - 10,950 days (noncarcinogenic effects), 25,550 (carcinogenic effects)

Table T-3

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Adult off-Site resident
- Inhalation of volatiles released from groundwater while showering (lower aquifer only)

$$\text{Intake (mg/kg-day)} = \frac{\text{CA} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CA = Contaminant concentration in air (mg/m<sup>3</sup>)

IR = Inhalation rate (m<sup>3</sup>/day)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CA - Modeled - see Appendix Z

IR - 20 m<sup>3</sup>/day (U.S. EPA, 1989)

ET - .28 hours/day (U.S. EPA, 1991 - see Appendix Z)

EF - 365 days/year (by convention)

ED - 30 years (national upper-bound time at one residence; U.S. EPA, 1989)

BW - 70 kg (U.S. EPA, 1989)

AT - 10,950 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

Table T-4

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Adult off-Site resident
- Inhalation of volatile chemicals released to air from subsurface contaminants or inhalation of fugitive dusts from Kapica-Pazmey surface soils

$$\text{Intake (mg/kg-day)} = \frac{\text{CA} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CA = Contaminant concentration in air (mg/m<sup>3</sup>)

IR = Inhalation rate (m<sup>3</sup>/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CA - Modeled concentration

IR - 20 m<sup>3</sup>/day (U.S. EPA, 1989)

EF - 182 days/year (professional judgement)

ED - 30 years (national upper-bound time at one residence; U.S. EPA, 1989)

BW - 70 kg (U.S. EPA, 1989)

AT - 10,950 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

Table T-5

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child off-Site resident
- Incidental ingestion of water (upper aquifer) while swimming in pool

$$\text{Intake (mg/kg-day)} = \frac{\text{CW} \times \text{CR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/L)

CR = Contact rate (L/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (day/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

CR - 0.05 L/hour (U.S. EPA, 1989)

ET - 2.6 hours/day (professional judgement)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)

Table T-6

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child off-Site resident
- Dermal absorption of contaminants in water (upper aquifer) while swimming in pool.

$$\text{Absorbed Dose (mg/kg-day)} = \frac{\text{CW} \times \text{SA} \times \text{PC} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/L)

SA = Skin surface area available for contact (cm<sup>2</sup>)

PC = Chemical-specific dermal permeability constant (cm/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (day/year)

ED = Exposure duration (years)

CF = Volumetric conversion factor for water (L/cm<sup>3</sup>)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

SA - 11,600 cm<sup>2</sup>; 50th percentile for male child 9-12 years old - total body surface area (U.S. EPA, 1989)

PC - Chemical-specific (Table 7-17)

ET - 2.6 hrs/day (U.S. EPA, 1989)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

CF - 1L/1000 cm<sup>3</sup>

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

Table T-7

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing (trespassing) on-Site
- Incidental ingestion of surface soils or wetland sediments

$$\text{Intake (mg/kg-day)} = \frac{\text{CS} \times \text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CS = Chemical concentration in soil (mg/kg)

IR = Ingestion rate (mg soil/day)

CF = Conversion factor (kg/mg)

FI = Fraction ingested from contaminated source (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CS - Site-specific

IR - 200 mg soil/day (U.S. EPA, 1989)

CF -  $10^{-6}$  kg/mg

FI - 50%, assume 50% from Site soils and 50% from wetland sediments

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

Table T-8

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing (trespassing) on-Site
- Dermal absorption of chemicals in surface soils or wetland sediments

$$\text{Absorbed dose (mg/kg-day)} = \frac{\text{CS} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CS = Chemical concentration in soil (mg/kg)

CF = Conversion factor (kg/mg)

SA = Skin surface area available for contact (cm<sup>2</sup>)

AF = Soil to skin adherence factor (mg/cm<sup>2</sup>)

ABS = Absorption factor (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CS - Site specific

CF - 10<sup>-6</sup> kg/mg

SA - 4,870 cm<sup>2</sup>; 9 to 10 year old male arms, hands, legs-50th percentile (U.S. EPA, 1989)

AF - 2.11 mg/cm<sup>2</sup>; Average potting soil and kaolin clay (U.S. EPA, 1989)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)

ABS - Assume 30% for organic compounds and 1% for inorganic compounds

Table T-9

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing (trespassing) on-Site
- Incidental ingestion of surface water while playing in wetlands

$$\text{Intake (mg/kg-day)} = \frac{\text{CW} \times \text{CR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/L)

CR = Contact rate (L/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

CR - 0.005L/hr (professional judgement)

ET - 3 hours/day (professional judgement)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)

**Table T-10****CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing (trespassing) on-Site
- Dermal absorption of chemicals in surface water while playing in wetlands

$$\text{Absorbed dose (mg/kg-day)} = \frac{\text{CW} \times \text{SA} \times \text{PC} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/L)

SA = Skin surface area available for contact (cm<sup>2</sup>)

PC = Chemical-specific dermal permeability constant (cm/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

CF = Volumetric conversion factor for water (L/cm<sup>3</sup>)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

SA - 4,970 cm<sup>2</sup>/event; 9 to 10 year old male arms, hands, legs-50th percentile (U.S. EPA, 1989)

RC - Chemical-specific (Table 7-17)

ET - 3 hours/day (professional judgement)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

CF - 1L/1000 cm<sup>3</sup>

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)

Table T-11

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing (trespassing) on-Site
- Inhalation of volatile chemicals or fugitive dusts while on-Site

$$\text{Intake (mg/kg-day)} = \frac{\text{CA} \times \text{IR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CA = Contaminant concentration in air (mg/m<sup>3</sup>)

IR = Inhalation rate (m<sup>3</sup>/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CA - Modeled concentration

IR - 3.2 m<sup>3</sup>/hour, child age 10 (U.S. EPA, 1989)

ET - 3 hours/day (professional judgement)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

## Table T-12

**CURRENT USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- On-Site workers at the ACS facility or Kapica-Pazmey facility
- Inhalation of volatile chemicals or dust

$$\text{Intake (mg/kg-day)} = \frac{\text{CA} \times \text{IR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CA = Contaminant concentration in air (mg/m<sup>3</sup>)

IR = Inhalation rate (m<sup>3</sup>/hours)

ET = Exposure time (hours/day)

EF = Exposure frequency (day/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CA - Modeled concentration

IR - 2.1 m<sup>3</sup>/hr, adult average (U.S. EPA, 1989)

ET - 8 hrs/day (standard work day)

EF - 130 days/year (5 days/week, 6 months/year)

ED - 30 years (U.S. EPA, 1989)

BW - 70 kg (U.S. EPA, 1989)

AT - 10,950 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)

Table T-13

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Hypothetical adult resident living on-Site
- Ingestion of groundwater (lower or upper aquifer)

$$\text{Intake (mg/kg-day)} = \frac{\text{CW} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/kg)

IR = Ingestion rate (L/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

IR - 2 L/day (U.S. EPA, 1989)

EF - 365 days/year (by convention)

ED - 30 years (national upper-bound time at one residence; U.S. EPA, 1989)

BW - 70 kg (U.S. EPA, 1989)

AT - 10,950 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

Table T-14

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Hypothetical adult resident living on-Site
- Dermal absorption of chemicals in water (lower or upper aquifer) while bathing

$$\text{Absorbed Dose (mg/kg-day)} = \frac{\text{CW} \times \text{SA} \times \text{PC} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{CF} \times \text{AV}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/L)

SA = Skin surface area available for contact (cm<sup>2</sup>)

PC = Chemical-specific dermal permeability constant (cm/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (day/year)

ED = Exposure duration (years)

CF = Volumetric conversion factor for water (L/cm<sup>3</sup>)

AV = Adjustment for contaminants released via volatilization (unitless)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

SA - 19,400 cm<sup>2</sup>; 50th percentile value for male adult - total body surface area (U.S. EPA, 1989)

PC - Chemical-specific (Table 7-17)

ET - 0.2 hrs/day (U.S. EPA, 1989)

EF - 365 days/year (professional judgement)

ED - 30 years (U.S. EPA, 1989)

CF - 1L/1000 cm<sup>3</sup>

AV - Volatiles - 90% volatilized, 10% available for dermal absorption; semivolatiles - 50% volatilized, 50% available for dermal absorption (see Appendix Y).

BW - 70 kg (U.S. EPA 1989)

AT - 10,950 days (noncarcinogenic effects), 25,550 (carcinogenic effects)

Table T-15

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Adult off-Site resident
- Inhalation of volatiles released from groundwater while showering (upper or lower aquifers)

$$\text{Intake (mg/kg-day)} = \frac{\text{CA} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CA = Contaminant concentration in air (mg/m<sup>3</sup>)

IR = Inhalation rate (m<sup>3</sup>/day)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CA - Modeled - see Appendix Z

IR - 20 m<sup>3</sup>/day (U.S. EPA, 1989)

ET - .28 hours/day (U.S. EPA, 1991 - see Appendix Z)

EF - 365 days/year (by convention)

ED - 30 years (national upper-bound time at one residence; U.S. EPA, 1989)

BW - 70 kg (U.S. EPA, 1989)

AT - 10,950 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

Table T-16

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Hypothetical adult resident living on-Site
- Inhalation of volatile chemicals released from subsurface wastes/soils

$$\text{Intake (mg/kg-day)} = \frac{\text{CA} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CA = Contaminant concentration in air (mg/m<sup>3</sup>)

IR = Inhalation rate (m<sup>3</sup>/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CA - Modeled concentration

IR - 20 m<sup>3</sup>/day (U.S. EPA, 1989)

EF - 182 days/year (professional judgement)

ED - 30 years (U.S. EPA, 1989)

BW - 70 kg (U.S. EPA, 1989)

AT - 10,950 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

**Table T-17**

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Hypothetical adult resident living on-Site
- Incidental ingestion of unearthed soils

$$\text{Intake (mg/kg-day)} = \frac{\text{CS} \times \text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CS = Chemical concentration in soil (mg/kg)

IR = Ingestion rate (mg/soil/day)

CF = Conversion factor ( $10^{-6}$  kg/mg)

FI = Fraction ingested from contaminated source (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CS - Site-specific

IR - 200 mg soil/day - children, 6/30 years; 100 mg soil/day - adults, 24/30 years  
(U.S. EPA, 1991)\*

CF -  $10^{-6}$  kg/mg

FI - 100% (professional judgement)

EF - 182 days/year, assume daily for 6 months/year (professional judgement)

ED - 30 years (U.S. EPA, 1989)

BW - 15 kg - children 6/30 years; adults, 24/30 years (U.S. EPA, 1991)\*

AT - 10,950 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

**Table T-17**  
**(Continued)**

\* Studies on soil ingestion rates for humans have found that children younger than six years old ingest more soil than older children and adults. For this reason, exposure to contaminated soil was modeled for two separate time periods within a persons lifetime; early childhood (years 0-6), and late childhood and early adulthood (7-30 years of age) (i.e., the remainder of an assumed thirty year exposure duration). To calculate health risk estimates, a time weighted soil ingestion rate, and body weight were used to account for the temporal changes in these exposure parameters. The following equations were used to calculate the time weighted soil ingestion rate and body weight.

	<u>0-6</u>	·	<u>7-30</u>	
<u>Time Weighted Soil Ingestion Rate</u> (mg/day)	200 mg/day (6/30)	+	100 mg/day (24/30)	= 120 mg/day
<u>Time Weighted Body weight</u> (kg)	15 kg (6/30)	+	70 kg (24/30)	= 59 kg

The values for the exposure parameters for each time period (e.g., 0-6) were obtained from the "Supplemental Guidance to the Risk Assessment Guidance for Superfund," published by the U.S. EPA (U.S. EPA, 1991). The time-specific exposure parameters were multiplied by the fraction of a thirty year exposure period for which the exposure parameter applied (i.e., 6/30 or 24/30). The values obtained for each time period were summed to arrive at the overall thirty year value for the exposure parameter (e.g., body weight; 59 kg).

Table T-18

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Hypothetical adult resident living on-Site
- Dermal absorption of chemicals in unearthed soils

$$\text{Absorbed dose (mg/kg-day)} = \frac{\text{CS} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

- CS = Chemical concentration in soil (mg/kg)
- CF = Conversion factor (kg/mg)
- SA = Skin surface area available for contact (cm<sup>2</sup>/event)
- AF = Soil to skin adherence factor (mg/cm<sup>2</sup>)
- ABS = Absorption factor (unitless)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged--days)
- 
- CS - Site specific
- CF - 10<sup>-6</sup> kg/mg
- SA - 8,620 cm<sup>2</sup>; Adult arms, hands, legs-50th percentile (U.S. EPA, 1989)
- AF - 2.11 mg/cm<sup>2</sup>; Average potting soil and kaolin clay (U.S. EPA, 1989)
- EF - 182 days/year, assume daily for 6 months/year (professional judgement)
- ED - 30 years (U.S. EPA, 1989)
- BW - 70 kg (U.S. EPA, 1989)
- AT - 10,950 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)
- ABS - Assume 30% for organic chemicals and 1% for inorganic chemicals

Table T-19

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing on-Site
- Incidental ingestion of surface water while playing in wetlands

$$\text{Intake (mg/kg-day)} = \frac{\text{CW} \times \text{CR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/L)

CR = Contact rate (L/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

CR - 0.005L/hr (professional judgement)

ET - 3 hours/day (professional judgement)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)

Table T-20

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing on-Site
- Dermal absorption of chemicals in surface water while playing in wetlands

$$\text{Absorbed dose (mg/kg-day)} = \frac{\text{CW} \times \text{SA} \times \text{PC} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}}$$

CW = Chemical concentration in water (mg/L)

SA = Skin surface area available for contact (cm<sup>2</sup>)

PC = Chemical-specific dermal permeability constant (cm/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

CF = Volumetric conversion factor for water (L/cm<sup>3</sup>)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CW - Site-specific

SA - 4,970 cm<sup>2</sup>/event; 9 to 10 year old male arms, hands, legs-50th percentile (U.S. EPA, 1989)

RC - Chemical-specific (Table 7-17)

ET - 3 hours/day (professional judgement)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

CF - 1L/1000 cm<sup>3</sup>

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)

Table T-21

**FUTURE USE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing on-Site
- Incidental ingestion of wetland sediments

$$\text{Intake (mg/kg-day)} = \frac{\text{CS} \times \text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

- CS = Chemical concentration in soil (mg/kg)
- IR = Ingestion rate (mg soil/day)
- CF = Conversion factor (kg/mg)
- FI = Fraction ingested from contaminated source (unitless)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged--days)

- CS - Site-specific
- IR - 100 mg soil/day (U.S. EPA, 1989)
- CF -  $10^{-6}$  kg/mg
- FI - 50%, assume 50% from Site soils and 50% from wetland sediments
- EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)
- ED - 10 years (professional judgement)
- BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)
- AT - 3,650 days (noncarcinogenic effects), 25,550 days (carcinogenic effects)

Table T-22

**FUTURE EXPOSURE**

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

- Child playing on-Site
- Dermal absorption of chemicals in wetland sediments

$$\text{Absorbed dose (mg/kg-day)} = \frac{\text{CS} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

CS = Chemical concentration in soil (mg/kg)

CF = Conversion factor (kg/mg)

SA = Skin surface area available for contact (cm<sup>2</sup>)

AF = Soil to skin adherence factor (mg/cm<sup>2</sup>)

ABS = Absorption factor (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged--days)

CS - Site specific

CF - 10<sup>-6</sup> kg/mg

SA - 4,870 cm<sup>2</sup>; 9 to 10 year old male arms, hands, legs-50th percentile (U.S. EPA, 1989)

AF - 2.11 mg/cm<sup>2</sup>; Average potting soil and kaolin clay (U.S. EPA, 1989)

EF - 2 days/wk x 26 wk/year = 52 days/year (professional judgement)

ED - 10 years (professional judgement)

BW - 30 kg; 50th percentile for male child 9 to 10 years old (U.S. EPA, 1989)

AT - 3,650 days (noncarcinogenic effects) 25,550 days (carcinogenic effects)

ABS - Assume 30% for organic compounds and 1% for inorganic compounds

**Appendix U**

**Evaluation of Analytical Data For Calculation  
of Exposure Point Concentrations**

## Appendix U

### EVALUATION OF ANALYTICAL DATA FOR CALCULATION OF EXPOSURE POINT CONCENTRATIONS

The analytical data collected from the ASC site has been organized into a form appropriate for the baseline risk assessment using the procedures outlined in "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual" (U.S. EPA., September 1989). Although the following methods were applied to all media, groundwater concentrations were used in the BRA, in a manner consistent with U.S. EPA's March 1991 Supplemental Guidance, and as discussed with the Region V RPM. The following seven criteria were used in evaluating the data.

1. All analytical results are tabulated by medium (soils, sediments, groundwater, and surface water), and grouped into source area identified by the following locations:
  - On-Site Containment Area
  - Still bottoms / Treatment lagoon
  - Off-Site Containment Area
  - Kapica-Pazmey
  - Groundwaters (upper and lower aquifer)
  - Surface waters
  - Sediments

In addition, results for Kapica-Pazmey are further divided into surface (0-3 ft) and sub-surface soil samples.

2. All analyses were performed using Contract Laboratory Program (CLP) methodology.
3. Qualifiers applied both by the performing laboratory and during data validation are evaluated.

All results qualified as unusable (U) are eliminated from further consideration.

Target list compounds qualified as estimated (J) are considered to be positively identified, but with the concentration estimated, and are included for further evaluation. Tentatively identified compounds (TICs) from the volatile and semi-volatile analyses are also qualified as estimated, but both the quantity and the identity are uncertain.

Compounds reported as undetected (U) are evaluated to determine if the sample quantitation limits were accurately calculated.

4. Sample Quantitation Limits (SQLs) are evaluated. All compounds detected in at least one sample from a given source area are evaluated.

Sample results for each compound detected are evaluated to determine the value to be included in the exposure concentration value for the quantitative risk assessment. For a given compound, all positive results are included. For samples where the compound was not detected, one half the SQL is included. If one half the SQL is greater than the maximum detected concentration for the source area, that result is eliminated from the quantitative risk assessment.

5. Blank results are reviewed to identify and eliminate sample results that represent sampling, transportation, or laboratory introduced contamination.
6. Tentatively identified compounds (TICs) are grouped according to chemical structure. Since TICs do not have detection limits, it is not possible to calculate UCL values. Instead, the maximum concentration of any TIC from within a TIC group from each given source area, is used as the exposure point concentration.
7. Background levels are compared to sample results. Inorganic chemicals present at the Site at naturally occurring levels are eliminated from further consideration, as described in Appendix S.
8. Potential transformation products of compounds detected in the sample operable unit are determined and included in the evaluation.

After the data has been evaluated using these criteria, a list of the samples by source area is made that will be used to estimate exposure concentration of the compounds detected. All compounds detected in a source area are included in the data evaluation (no screening procedure is employed).

#### QUANTITATION OF REASONABLE MAXIMUM EXPOSURE CONCENTRATION

The list of chemicals of potential concern for each source area as discussed in Appendix S is used to determine the exposure point concentrations. The data has been assumed to be log-normally distributed. This has been confirmed through analysis of covariance (Table U-19). The arithmetic mean of the log-transformed data has been calculated. The 95 percent upper confidence limit has been calculated for this log-transformed data and considered in determining exposure point concentrations.

#### CALCULATIONS

For each compound detected in a source area, the following calculation routine is performed:

## 1. DATA EVALUATION

1.1 Determine the maximum detected concentration.

1.2 For non-detect results, calculate 1/2 the SQL

$$1/2 \text{ SQL} = \text{CRQL} \times \text{DF} \times 0.5$$

where

CRQL = contract required detection limit

DF = CRQL factor (as presented in the analytical results) to correct for dilutions, percent moisture, or changes in the sample analytical dilution/concentration procedure.

For non-detect results where a specific SQL is presented in the analytical results, use 1/2 that value.

1.3 Compare the 1/2 SQL value to the maximum detected concentration. Eliminate 1/2 SQL values that exceed the maximum detected concentration.

1.4 Prepare a data set table of the positive detects and 1/2 SQLs as evaluated above for each media of interest.

## 2. EXPOSURE CONCENTRATION CALCULATION

The 95% UCL is calculated on the log normally distributed data. This requires the data set to be transformed before the 95% UCL can be calculated. For each compound:

2.1 Transformed Data set. Calculate the natural log of each value in the data set.

2.2 Calculate the arithmetic average of the transformed data set.

2.3 Calculate the standard deviation of the transformed data set.

2.4 Calculate the variance for the transformed data set.

2.5 Determine the number of data points (n) included in the data sets.

2.6 Determine the Hv statistic. This value is taken from statistical tables for a one-sided upper 95% confidence limit on a log normal mean (geometric mean; the geometric mean was used to estimate the "true" mean) as presented in Gilbert (1987). The standard deviation and the number of data points (n) are required to determine this value.

2.7 Calculate the 95% UCL:

$$\text{EXP}(\text{AVE} + (0.5 \text{ VAR}) + ((\text{STD} * \text{Hv}) / \text{SQRT}(n-1)))$$

where

EXP = inverse base e logarithm  
AVE = arithmetic average of the transformed data set  
STD = standard deviation of the transformed data set  
VAR = variance (STD \* STD)  
Hv = as determined in #6 above  
SQRT = square root

2.8 Determine the value to be used for the exposure point concentration. Compare the 95% UCL value (section 2.7 above) to the maximum detected concentration (section 1.1). The 95% UCL value is used unless it exceeds the maximum detected concentration. The exception to this is for the future use groundwater scenario where the maximum concentration has been used.

The exposure point concentration calculations are presented in tables at the end of this appendix. A summary of exposure point concentrations for all source areas is presented in Table 7-16

Table U - 1

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Groundwater  
Source Area: Lower Aquifer

Chemical Of Potential Concern	95% UCLM Calculation					UCLM (95%)	Max. Det. Conc. (ug/L)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n			(ug/L)	(mg/L)
Arsenic	0.91	0.70	2.90	0.49	8	6.82e+00	8.60e+00	8.60e+00	8.60e-03
Barium	5.07	0.51	2.47	0.26	8	2.89e+02	3.10e+02	3.10e+02	3.10e-01
Calcium	11.42	0.45	2.28	0.20	8	1.49e+05	1.51e+05	1.51e+05	1.51e+02
Copper	2.39	0.25	1.99	0.06	8	1.35e+01	2.00e+01	2.00e+01	2.00e-02
Iron	5.84	1.32	4.43	1.74	8	7.44e+03	3.16e+03	3.16e+03	3.16e+00
Magnesium	10.20	0.54	2.47	0.29	8	5.16e+04	5.31e+04	5.31e+04	5.31e+01
Manganese	5.31	0.80	3.16	0.65	8	7.29e+02	8.66e+02	8.66e+02	8.66e-01
Mercury	-1.68	0.49	2.47	0.24	8	3.31e-01	4.70e-01	4.70e-01	4.70e-04
Potassium	7.33	0.52	2.47	0.27	8	2.84e+03	3.42e+03	3.42e+03	3.42e+00
Selenium	0.69	0.00	1.89	0.00	8	2.00e+00	2.00e+00	2.00e+00	2.00e-03
Sodium	10.11	0.85	3.16	0.72	8	9.68e+04	9.62e+04	9.62e+04	9.62e+01
Vanadium	0.24	0.36	2.28	0.13	8	1.85e+00	2.40e+00	2.40e+00	2.40e-03
Zinc	1.88	0.55	2.47	0.30	8	1.27e+01	2.20e+01	2.20e+01	2.20e-02

Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.
- Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.
- H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)
- Variance = Variance of the natural log of the detected concentration or the 1/2 SQL
- n = Number of data points
- UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT (n-1)))$
- Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.
- Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc. , whichever is lower.  
For groundwater, residents are assumed to be exposed to a single contaminant concentration, not an average of the entire aquifer. As such, the maximum concentration is used as the exposure concentration.

Table U - 2

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Groundwater  
Source Area: Lower Aquifer

Chemical Of Potential Concern	95% UCLM Calculation						Max. Det. Conc. (ug/L)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		(ug/L)	(mg/L)
Chloroethane	2.46	1.85	4.80	3.43	9	1.50e+03	4.40e+02	4.40e+02	4.40e-01
4-Methyl-2-Pentanone	1.10	ERR	2.75	ERR	1	ERR	3.00e+00	3.00e+00	3.00e-03
bis(2-Chloroethyl)ether	1.79	0.37	2.09	0.14	9	8.44e+00	1.20e+01	1.20e+01	1.20e-02

Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.
- Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.
- H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)
- Variance = Variance of the natural log of the detected concentration or the 1/2 SQL
- n = Number of data points
- UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / \sqrt{n-1}))$
- Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.
- Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc. , whichever is lower.  
For groundwater, residents are assumed to be exposed to a single contaminant concentration, not an average of the entire aquifer. As such, the maximum concentration is used as the exposure concentration.
- ERR = Statistical operations cannot be performed on a single data point.

Table U - 3

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Groundwater  
Source Area: Upper Aquifer

Chemical	----- 95% UCLM Calculation -----						Max. Det. Conc. (ug/L)	----- Exposure Point Conc. -----	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		(ug/L)	(mg/L)
Arsenic	1.48	1.32	2.92	1.74	26	2.27e+01	4.32e+01	4.32e+01	4.32e-02
Barium	5.56	0.94	2.43	0.88	26	6.36e+02	1.84e+03	1.84e+03	1.84e+00
Beryllium	-2.27	0.18	1.77	0.03	26	1.12e-01	2.50e-01	2.50e-01	2.50e-04
Cadmium	-1.85	0.84	2.31	0.71	26	3.30e-01	3.10e+00	3.10e+00	3.10e-03
Chromium, Total	-0.46	0.87	2.43	0.75	26	1.40e+00	3.90e+00	3.90e+00	3.90e-03
Lead	0.48	0.26	1.83	0.07	26	1.83e+00	4.60e+00	4.60e+00	4.60e-03
Manganese	7.05	1.35	2.92	1.81	26	6.26e+03	4.25e+03	4.25e+03	4.25e+00
Mercury	-1.77	0.66	2.19	0.43	26	2.81e-01	1.70e+00	1.70e+00	1.70e-03
Nickel	3.10	0.30	1.83	0.09	26	2.59e+01	5.30e+01	5.30e+01	5.30e-02
Selenium	0.13	0.40	1.91	0.16	26	1.43e+00	6.20e+00	6.20e+00	6.20e-03
Sodium	10.84	1.46	3.31	2.12	26	3.85e+05	4.44e+05	4.44e+05	4.44e+02
Thallium	0.59	0.30	1.83	0.09	26	2.10e+00	4.00e+00	4.00e+00	4.00e-03
Vanadium	0.94	0.93	2.43	0.87	26	6.26e+00	2.59e+01	2.59e+01	2.59e-02
Zinc	3.43	1.34	2.92	1.79	26	1.64e+02	8.86e+02	8.86e+02	8.86e-01
Cyanide, Total	1.64	0.14	1.72	0.02	26	5.43e+00	1.00e+01	1.00e+01	1.00e-02
Aluminum	5.33	0.09	1.72	0.01	26	2.15e+02	2.80e+02	2.80e+02	2.80e-01
Calcium	11.69	0.80	2.31	0.65	26	2.38e+05	1.04e+06	1.04e+06	1.04e+03
Iron	7.54	2.32	5.01	5.39	26	2.85e+05	2.18e+05	2.18e+05	2.18e+02
Magnesium	10.22	0.56	2.09	0.31	26	4.08e+04	7.88e+04	7.88e+04	7.88e+01
Potassium	8.73	1.09	2.56	1.18	26	1.96e+04	9.58e+04	9.58e+04	9.58e+01

Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.
  - Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.
  - H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert-1987, table A12)
  - Variance = Variance of the natural log of the detected concentration or the 1/2 SQL
  - n = Number of data points
  - UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT (n-1)))$
  - Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.
  - Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.
- For groundwater, residents are assumed to be exposed to a single contaminant concentration, not an average of the entire aquifer. As such, the maximum concentration is used as the exposure concentration.

Table U - 4

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Groundwater  
Source Area: Upper Aquifer

Chemical Of Potential Concern	----- 95% UCLM Calculation -----					UCLM (95%)	Max. Det. Conc. (ug/L)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n			(ug/L)	(mg/L)
Chloromethane	1.97	0.82	2.31	0.67	23	1.51e+01	6.80e+01	6.80e+01	6.80e-02
Vinyl Chloride	2.26	1.42	3.31	2.03	23	7.25e+01	7.20e+02	7.20e+02	7.20e-01
Chloroethane	3.44	2.22	4.14	4.92	24	2.47e+03	2.00e+03	2.00e+03	2.00e+00
Methylene Chloride	2.23	1.83	3.72	3.35	23	2.12e+02	3.80e+02	3.80e+02	3.80e-01
Acetone	2.85	2.79	5.91	7.76	23	2.80e+04	9.90e+04	9.90e+04	9.90e+01
1,1-Dichloroethane	1.98	2.23	4.14	4.95	24	5.87e+02	2.40e+03	2.40e+03	2.40e+00
Total 1,2-Dichloroethene	1.72	1.64	3.72	2.70	23	7.94e+01	4.00e+02	4.00e+02	4.00e-01
2-Butanone	3.46	3.64	7.60	13.24	17	2.40e+07	2.20e+05	2.20e+05	2.20e+02
Trichloroethene	1.31	0.87	2.31	0.76	22	8.35e+00	4.50e+01	4.50e+01	4.50e-02
Benzene	3.48	3.29	6.82	10.84	24	7.87e+05	1.00e+05	1.00e+05	1.00e+02
4-Methyl-2-Pentanone	2.85	2.77	5.01	7.66	24	1.45e+04	5.40e+04	5.40e+04	5.40e+01
2-Hexanone	2.35	1.69	3.72	2.86	23	1.68e+02	1.80e+03	1.80e+03	1.80e+00
Tetrachloroethene	1.52	1.30	2.92	1.68	23	2.38e+01	2.00e+02	2.00e+02	2.00e-01
Toluene	1.92	1.89	4.14	3.59	24	2.11e+02	2.30e+03	2.30e+03	2.30e+00
Chlorobenzene	1.45	1.10	2.56	1.20	22	1.43e+01	9.60e+01	9.60e+01	9.60e-02
Ethylbenzene	2.23	2.20	4.14	4.84	24	7.04e+02	1.10e+03	1.10e+03	1.10e+00
Total Xylenes	2.27	2.27	4.14	5.14	24	9.00e+02	3.00e+03	3.00e+03	3.00e+00
Phenol	1.98	0.93	2.43	0.87	24	1.80e+01	2.40e+02	2.40e+02	2.40e-01
bis(2-Chloroethyl)ether	2.22	1.19	2.92	1.41	24	3.82e+01	2.50e+02	2.50e+02	2.50e-01
1,3-Dichlorobenzene	1.10	ERR	2.75	ERR	1	ERR	3.00e+00	3.00e+00	3.00e-03
1,4-Dichlorobenzene	1.60	0.21	1.77	0.04	24	5.50e+00	1.00e+01	1.00e+01	1.00e-02
1,2-Dichlorobenzene	1.88	0.61	2.09	0.37	24	1.03e+01	3.30e+01	3.30e+01	3.30e-02
2-Methylphenol	1.70	0.52	1.99	0.27	22	7.88e+00	3.80e+01	3.80e+01	3.80e-02
bis(2-Chloroisopropyl)ether	2.27	1.35	2.92	1.81	24	5.46e+01	3.00e+02	3.00e+02	3.00e-01
4-Methylphenol	2.15	1.44	3.31	2.08	22	6.91e+01	2.20e+03	2.20e+03	2.20e+00
Isophorone	1.81	0.56	2.09	0.31	24	9.13e+00	3.50e+01	3.50e+01	3.50e-02
2,4-Dimethylphenol	1.78	0.66	2.19	0.44	22	1.01e+01	1.10e+02	1.10e+02	1.10e-01
Benzoic acid	3.03	1.21	2.92	1.46	24	9.00e+01	1.90e+03	1.90e+03	1.90e+00
Naphthalene	1.91	0.86	2.43	0.73	24	1.51e+01	7.10e+01	7.10e+01	7.10e-02
4-Chloro-3-methylphenol	1.15	0.65	7.81	0.42	2	6.14e+02	5.00e+00	5.00e+00	5.00e-03
2-Methylnaphthalene	1.75	0.41	1.91	0.17	24	7.38e+00	2.70e+01	2.70e+01	2.70e-02
Diethylphthalate	1.61	0.16	1.77	0.03	24	5.40e+00	9.00e+00	9.00e+00	9.00e-03
Pentachlorophenol	0.90	0.29	4.11	0.08	2	8.29e+00	3.00e+00	3.00e+00	3.00e-03
Di-n-butylphthalate	0.69	ERR	2.75	ERR	1	ERR	2.00e+00	2.00e+00	2.00e-03
bis(2-Ethylhexyl)phthalate	1.71	0.67	2.19	0.45	24	9.40e+00	5.00e+01	5.00e+01	5.00e-02
AROCLOR-1248	-1.19	0.66	2.19	0.44	24	5.11e-01	2.60e+00	2.60e+00	2.60e-03

Table U - 4

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Groundwater  
Source Area: Upper Aquifer

Chemical Of Potential Concern	----- 95% UCLM Calculation -----					n	UCLM (95%)	Max. Det. Conc. (ug/L)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	(ug/L)				(mg/L)	
AROCLOR-1260	-0.53	0.81	2.31	0.66	24	1.22e+00	2.70e+01	2.70e+01	2.70e-02	

Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.
- Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.
- H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)
- Variance = Variance of the natural log of the detected concentration or the 1/2 SQL
- n = Number of data points
- UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT (n-1)))$
- Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.
- Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc. , whichever is lower.  
For groundwater, residents are assumed to be exposed to a single contaminant concentration, not an average of the entire aquifer. As such, the maximum concentration is used as the exposure concentration.
- ERR = Statistical operations cannot be performed on a single data point.

Table U - 5

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Surface Water  
Source Area: ACS

Chemical	----- 95% UCLM Calculation -----					UCLM (95%)	Max. Det. Conc. (ug/L)	----- Exposure Point Conc. -----	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n			(ug/L)	(mg/L)
Aluminum	5.77	1.10	4.91	1.20	5	8.63e+03	9.60e+02	9.60e+02	9.60e-01
Arsenic	0.93	1.65	8.25	2.72	5	8.87e+03	4.50e+01	4.50e+01	4.50e-02
Barium	4.84	0.53	2.95	0.29	5	3.22e+02	3.30e+02	3.22e+02	3.22e-01
Beryllium	-2.10	0.46	2.95	0.21	5	2.69e-01	2.80e-01	2.69e-01	2.69e-04
Cadmium	-1.65	0.93	4.48	0.86	5	2.38e+00	7.20e-01	7.20e-01	7.20e-04
Calcium	10.96	1.41	7.12	1.98	5	2.33e+07	3.34e+05	3.34e+05	3.34e+02
Chromium, Total	1.89	1.08	4.91	1.16	5	1.67e+02	2.80e+01	2.80e+01	2.80e-02
Copper	2.46	0.35	2.40	0.12	5	1.90e+01	2.20e+01	1.90e+01	1.90e-02
Iron	7.76	1.58	7.12	2.51	5	2.31e+06	1.43e+04	1.43e+04	1.43e+01
Lead	2.15	0.78	4.06	0.61	5	5.69e+01	2.38e+01	2.38e+01	2.38e-02
Magnesium	9.25	1.63	8.25	2.65	5	3.23e+07	6.17e+04	6.17e+04	6.17e+01
Manganese	5.68	1.97	9.39	3.87	5	2.08e+07	1.85e+03	1.85e+03	1.85e+00
Nickel	3.48	0.67	3.66	0.45	5	1.38e+02	8.00e+01	8.00e+01	8.00e-02
Potassium	8.54	1.57	7.12	2.48	5	4.78e+06	3.00e+04	3.00e+04	3.00e+01
Selenium	0.15	0.33	2.40	0.11	5	1.83e+00	2.10e+00	1.83e+00	1.83e-03
Sodium	9.35	2.14	9.39	4.60	5	2.70e+09	8.23e+04	8.23e+04	8.23e+01
Zinc	3.95	0.46	2.95	0.21	5	1.14e+02	8.80e+01	8.80e+01	8.80e-02

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.

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Table U - 6

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Surface Water  
Source Area: ACS

Chemical Of Potential Concern	----- 95% UCLM Calculation -----					n	UCLM (95%)	Max. Det. Conc. (ug/L)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	(ug/L)				(mg/L)	
Chloroethane	2.17	0.82	4.06	0.67	5	6.47e+01	3.00e+01	3.00e+01	3.00e-02	
Acetone	2.48	1.94	9.39	3.75	5	6.88e+05	3.80e+02	3.80e+02	3.80e-01	
1,1-Dichloroethane	0.35	0.49	6.50	0.24	2	3.85e+01	2.00e+00	2.00e+00	2.00e-03	
Total 1,2-Dichloroethene	0.77	0.44	2.65	0.19	5	4.24e+00	3.00e+00	3.00e+00	3.00e-03	
2-Butanone	2.65	1.52	7.12	2.30	5	9.99e+03	1.40e+02	1.40e+02	1.40e-01	
Benzene	1.96	2.33	11.67	5.44	5	8.75e+07	4.60e+02	4.60e+02	4.60e-01	
4-Methyl-2-Pentanone	2.07	1.02	4.91	1.04	5	1.62e+02	4.90e+01	4.90e+01	4.90e-02	
Toluene	1.35	0.60	3.29	0.36	5	1.25e+01	8.00e+00	8.00e+00	8.00e-03	
Ethylbenzene	1.09	0.39	2.65	0.15	5	5.40e+00	6.00e+00	5.40e+00	5.40e-03	
Total Xylenes	1.44	1.18	6.00	1.39	5	2.93e+02	3.50e+01	3.50e+01	3.50e-02	
Phenol	2.35	1.05	4.91	1.10	5	2.37e+02	4.50e+01	4.50e+01	4.50e-02	
bis(2-Chloroethyl)ether	2.16	1.22	6.00	1.50	5	7.16e+02	7.70e+01	7.70e+01	7.70e-02	
2-Methylphenol	1.61	0.00	2.04	0.00	5	5.00e+00	5.00e+00	5.00e+00	5.00e-03	
bis(2-Chloroisopropyl)ether	1.96	0.79	4.06	0.62	5	4.78e+01	2.90e+01	2.90e+01	2.90e-02	
4-Methylphenol	2.68	2.08	9.39	4.34	5	2.26e+06	5.90e+02	5.90e+02	5.90e-01	
Isophorone	1.61	0.00	2.04	0.00	5	5.00e+00	5.00e+00	5.00e+00	5.00e-03	
2,4-Dimethylphenol	1.78	0.39	2.65	0.15	5	1.08e+01	1.20e+01	1.08e+01	1.08e-02	
Benzoic acid	3.46	0.55	2.95	0.30	5	8.31e+01	8.50e+01	8.31e+01	8.31e-02	
4-Chloro-3-methylphenol	0.69	ERR	2.75	ERR	1	ERR	2.00e+00	2.00e+00	2.00e-03	
AROCLOR-1248	-1.01	0.55	2.95	0.31	5	9.63e-01	8.40e-01	8.40e-01	8.40e-04	

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / \sqrt{n-1}))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.  
 ERR = Statistical operations cannot be performed on a single data point.

Table U - 7

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soils  
Source Area: Onsite Containment Area

Chemical of Potential Concern	----- 95% UCLM Calculation -----						Max. Det. Conc. (mg/kg)	Exp. Pnt. Conc. (mg/kg)
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		
Barium	3.37	0.83	2.44	0.68	14	7.18e+01	5.15e+02	7.18e+01
Calcium	7.53	2.08	4.56	4.33	14	2.26e+05	3.83e+04	3.83e+04
Chromium, total	1.91	1.32	3.16	1.73	14	5.09e+01	2.71e+02	5.09e+01
Cobalt	1.66	0.52	2.07	0.27	14	8.10e+00	2.24e+01	8.10e+00
Magnesium	7.68	1.22	3.16	1.49	14	1.33e+04	1.74e+04	1.33e+04
Mercury	-3.40	1.71	4.08	2.94	14	1.01e+00	1.24e+01	1.01e+00
Selenium,	-1.38	0.18	1.81	0.03	14	2.80e-01	4.50e-01	2.80e-01
Cyanide, total	0.50	0.48	2.07	0.23	14	2.43e+00	8.70e+00	2.43e+00

Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.
- Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.
- H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)
- Variance = Variance of the natural log of the detected concentration or the 1/2 SQL
- n = Number of data points
- UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT(n-1)))$
- Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.
- Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc. , whichever is lower.

Table U - 8

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected ConcentrationMedia: Soils  
Source Area: Onsite Containment Area

Chemical Of Potential Concern	95% UCLM Calculation					UCLM (95%)	Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n			(ug/kg)	(mg/kg)
Chloroethane	6.83	6.84	32.43	46.79	5	ERR	1.60e+07	1.60e+07	1.60e+04
Acetone	5.06	1.96	3.81	3.83	40	3.51e+03	7.40e+03	3.51e+03	3.51e+00
1,1-Dichloroethane	1.39	1.03	2.56	1.05	23	1.19e+01	2.50e+02	1.19e+01	1.19e-02
Total 1,2-Dichloroethene	3.92	2.51	4.59	6.30	40	7.40e+03	5.20e+03	5.20e+03	5.20e+00
Chloroform	2.53	2.35	4.59	5.53	30	1.48e+03	6.40e+03	1.48e+03	1.48e+00
1,2-Dichloroethane	3.20	2.44	4.59	5.96	38	3.06e+03	9.70e+02	9.70e+02	9.70e-01
2-Butanone	3.23	1.44	3.31	2.07	22	2.01e+02	2.10e+02	2.01e+02	2.01e-01
1,1,1-Trichloroethane	4.31	3.62	5.68	13.12	42	1.31e+06	2.00e+07	1.31e+06	1.31e+03
1,2-Dichloropropane	2.52	2.24	3.81	5.03	30	7.51e+02	1.50e+03	7.51e+02	7.51e-01
Trichloroethene	3.63	2.75	4.59	7.56	41	1.22e+04	4.00e+04	1.22e+04	1.22e+01
1,1,2-Trichloroethane	1.60	1.43	3.31	2.04	24	3.67e+01	7.40e+02	3.67e+01	3.67e-02
Benzene	5.12	3.22	4.95	10.37	42	3.61e+05	7.10e+06	3.61e+05	3.61e+02
4-Methyl-2-Pentanone	2.95	1.88	4.14	3.52	26	5.23e+02	7.50e+02	5.23e+02	5.23e-01
Tetrachloroethene	4.81	4.03	6.42	16.25	42	2.38e+07	5.90e+06	5.90e+06	5.90e+03
1,1,2,2-Tetrachloroethane	3.57	2.64	4.59	6.95	40	7.95e+03	3.90e+03	3.90e+03	3.90e+00
Toluene	6.10	4.01	6.42	16.11	42	7.93e+07	2.00e+08	7.93e+07	7.93e+04
Chlorobenzene	1.68	1.48	3.31	2.20	25	4.40e+01	3.00e+02	4.40e+01	4.40e-02
Ethylbenzene	5.34	3.81	6.42	14.52	42	1.36e+07	6.70e+06	6.70e+06	6.70e+03
Styrene	3.49	2.68	4.59	7.17	40	8.46e+03	6.20e+03	6.20e+03	6.20e+00
Total Xylenes	7.05	4.07	6.42	16.58	42	2.74e+08	2.50e+07	2.50e+07	2.50e+04
Phenol	5.36	0.69	2.41	0.47	13	4.32e+02	7.80e+02	4.32e+02	4.32e-01
1,3-Dichlorobenzene	5.27	0.25	1.84	0.06	12	2.30e+02	3.50e+02	2.30e+02	2.30e-01
1,4-Dichlorobenzene	5.63	0.67	2.41	0.44	12	5.63e+02	1.20e+03	5.63e+02	5.63e-01
1,2-Dichlorobenzene	6.57	1.66	4.08	2.76	14	1.86e+04	9.90e+03	9.90e+03	9.90e+00
2-Methylphenol	5.39	1.24	3.39	1.53	13	1.58e+03	9.20e+03	1.58e+03	1.58e+00
4-Methylphenol	5.66	1.32	3.39	1.74	13	2.51e+03	1.70e+04	2.51e+03	2.51e+00
2,4-Dimethylphenol	5.64	1.31	3.39	1.71	13	2.39e+03	1.20e+04	2.39e+03	2.39e+00
Benzoic acid	3.89	ERR	2.75	ERR	1	ERR	4.90e+01	4.90e+01	4.90e-02
2,4-Dichlorophenol	5.23	0.26	1.93	0.07	12	2.25e+02	2.80e+02	2.25e+02	2.25e-01
Naphthalene	7.20	2.15	4.56	4.62	14	2.05e+05	9.00e+04	9.00e+04	9.00e+01
2-Methylnaphthalene	6.47	2.12	4.56	4.49	14	8.93e+04	5.50e+04	5.50e+04	5.50e+01
2,4,5-Trichlorophenol	5.30	0.11	1.80	0.01	11	2.13e+02	2.70e+02	2.13e+02	2.13e-01
Dimethylphthalate	5.95	3.13	39.23	9.78	2	ERR	3.50e+03	3.50e+03	3.50e+00
Acenaphthylene	5.63	0.93	2.74	0.87	13	8.98e+02	5.50e+03	8.98e+02	8.98e-01
Acenaphthene	5.87	1.19	3.16	1.42	14	2.06e+03	1.10e+04	2.06e+03	2.06e+00
Diethylphthalate	3.84	0.02	2.75	0.00	2	4.85e+01	4.70e+01	4.70e+01	4.70e-02
Fluorene	5.89	1.24	3.16	1.54	14	2.32e+03	1.40e+04	2.32e+03	2.32e+00
Pentachlorophenol	5.08	ERR	2.75	ERR	1	ERR	1.60e+02	1.60e+02	1.60e-01
Phenanthrene	5.98	1.40	3.61	1.96	14	4.26e+03	2.00e+04	4.26e+03	4.26e+00
Anthracene	4.54	ERR	2.75	ERR	1	ERR	9.40e+01	9.40e+01	9.40e-02

Table U - 8

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soils  
Source Area: Onsite Containment Area

Chemical Of Potential Concern	95% UCLM Calculation						Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		(ug/kg)	(mg/kg)
Di-n-butylphthalate	6.06	1.67	4.08	2.81	14	1.16e+04	3.60e+04	1.16e+04	1.16e+01
Fluoranthene	5.48	0.95	2.74	0.90	13	7.93e+02	3.80e+03	7.93e+02	7.93e-01
Pyrene	5.63	0.95	2.74	0.91	13	9.34e+02	5.90e+03	9.34e+02	9.34e-01
Butylbenzylphthalate	5.87	1.24	3.16	1.54	14	2.27e+03	1.50e+04	2.27e+03	2.27e+00
Benzo(a)anthracene	5.14	ERR	2.75	ERR	1	ERR	1.70e+02	1.70e+02	1.70e-01
Chrysene	4.43	ERR	2.75	ERR	1	ERR	8.40e+01	8.40e+01	8.40e-02
bis(2-Ethylhexyl)phthalate	5.83	2.58	5.56	6.68	14	5.16e+05	1.40e+05	1.40e+05	1.40e+02
Endosulfan 1	1.67	0.25	1.74	0.06	28	5.95e+00	1.20e+01	5.95e+00	5.95e-03
4,4-DDT	2.41	0.55	1.93	0.30	28	1.59e+01	9.10e+01	1.59e+01	1.59e-02
AROCLOR-1242	4.66	2.23	3.81	4.96	30	6.08e+03	4.00e+05	6.08e+03	6.08e+00
AROCLOR-1248	4.34	1.16	2.74	1.33	30	2.68e+02	4.50e+03	2.68e+02	2.68e-01
AROCLOR-1254	5.22	1.62	3.08	2.62	30	1.73e+03	1.00e+05	1.73e+03	1.73e+00

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.  
 ERR = Statistical operations cannot be performed.

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Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soils  
Source Area: Offsite Containment Area

Chemical of Potential Concern	----- 95% UCLM Calculation -----						Max. Det. Conc. (mg/kg)	Exp. Pnt. Conc. (mg/kg)
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		
Antimony	1.67	2.03	6.75	4.13	8	7.47e+03	1.52e+02	1.52e+02
Barium	3.95	1.48	3.31	2.18	19	4.90e+02	6.40e+03	4.90e+02
Cadmium	1.02	2.57	5.56	6.61	18	2.41e+03	1.70e+03	1.70e+03
Calcium	8.57	1.96	4.14	3.85	19	2.43e+05	5.05e+04	5.05e+04
Chromium, total	3.33	1.70	3.72	2.89	19	5.26e+02	3.75e+03	5.26e+02
Cobalt	2.20	0.70	2.19	0.49	19	1.65e+01	6.91e+01	1.65e+01
Copper	3.61	1.95	4.14	3.82	19	1.67e+03	5.79e+03	1.67e+03
Lead	4.22	2.18	4.14	4.76	19	6.18e+03	1.72e+04	6.18e+03
Manganese	4.52	0.98	2.56	0.95	19	2.66e+02	4.41e+02	2.66e+02
Mercury	-1.77	2.01	4.14	4.04	19	9.17e+00	3.60e+01	9.17e+00
Nickel	2.37	0.95	2.43	0.91	19	2.91e+01	7.26e+01	2.91e+01
Potassium	6.27	1.17	2.92	1.36	19	2.33e+03	8.10e+03	2.33e+03
Selenium	-0.57	1.68	3.72	2.81	19	1.00e+01	1.57e+02	1.00e+01
Silver	0.55	1.27	2.92	1.61	19	9.23e+00	3.12e+02	9.23e+00
Zinc	4.95	1.48	3.31	2.19	19	1.34e+03	4.70e+03	1.34e+03
Cyanide, total	0.86	0.91	2.43	0.82	19	5.99e+00	3.13e+01	5.99e+00
Percent solids	4.35	0.16	1.77	0.02	19	8.38e+01	9.10e+01	8.38e+01

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max.-Det. Conc., whichever is lower.

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Table U - 10

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soils  
Source Area: Offsite Containment Area

Chemical Of Potential Concern	95% UCLM Calculation						Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	z value	Variance	n	UCLM (95%)		(ug/kg)	(mg/kg)
Vinyl Chloride	4.52	2.58	5.01	6.68	23	4.10e+04	2.90e+03	2.90e+03	2.90e+00
Chloroethane	4.37	2.51	5.01	6.28	22	2.82e+04	2.00e+03	2.00e+03	2.00e+00
Methylene Chloride	7.25	3.11	5.39	9.66	37	2.88e+06	2.10e+05	2.10e+05	2.10e+02
Acetone	9.55	3.09	4.95	9.54	44	1.71e+07	3.40e+07	1.71e+07	1.71e+04
1,1-Dichloroethene	6.35	3.56	5.68	12.64	42	7.47e+06	3.90e+05	3.90e+05	3.90e+02
1,1-Dichloroethane	6.90	3.50	5.68	12.23	43	9.59e+06	4.90e+05	4.90e+05	4.90e+02
Total 1,2-Dichloroethene	6.44	2.96	5.39	8.78	38	6.98e+05	3.40e+04	3.40e+04	3.40e+01
Chloroform	7.23	3.95	6.42	15.59	44	1.60e+08	2.80e+06	2.80e+06	2.80e+03
1,2-Dichloroethane	6.99	3.25	4.95	10.54	43	2.51e+06	4.40e+05	4.40e+05	4.40e+02
2-Butanone	10.07	3.67	5.68	13.49	44	4.86e+08	9.90e+07	9.90e+07	9.90e+04
1,1,1-Trichloroethane	8.16	4.46	7.17	19.88	44	9.51e+09	1.50e+08	1.50e+08	1.50e+05
1,2-Dichloropropane	6.18	3.18	5.39	10.08	39	1.20e+06	6.80e+04	6.80e+04	6.80e+01
Trichloroethene	8.24	4.26	7.17	18.12	44	3.44e+09	1.90e+07	1.90e+07	1.90e+04
1,1,2-Trichloroethane	6.63	3.67	5.68	13.48	43	1.60e+07	4.00e+05	4.00e+05	4.00e+02
Benzene	7.92	3.42	5.68	11.67	44	1.82e+07	1.50e+06	1.50e+06	1.50e+03
4-Methyl-2-Pentanone	9.61	3.61	5.68	13.02	44	2.30e+08	6.10e+07	6.10e+07	6.10e+04
2-Hexanone	6.71	3.08	5.39	9.48	34	1.69e+06	4.70e+04	4.70e+04	4.70e+01
Tetrachloroethene	9.06	4.37	7.17	19.09	44	1.43e+10	4.60e+07	4.60e+07	4.60e+04
1,1,2,2-Tetrachloroethane	1.51	0.64	2.37	0.41	11	8.93e+00	1.70e+01	8.93e+00	8.93e-03
Toluene	10.39	4.19	6.42	17.54	44	1.27e+10	1.30e+08	1.30e+08	1.30e+05
Chlorobenzene	6.88	3.84	7.02	14.78	41	1.12e+08	1.00e+06	1.00e+06	1.00e+03
Ethylbenzene	9.34	4.24	6.42	18.02	44	5.95e+09	2.30e+07	2.30e+07	2.30e+04
Styrene	6.83	3.69	5.68	13.61	43	2.11e+07	3.10e+05	3.10e+05	3.10e+02
Total Xylenes	10.66	4.48	7.17	20.07	44	1.30e+11	1.00e+08	1.00e+08	1.00e+05
Phenol	9.22	2.20	3.81	4.84	32	5.12e+05	8.60e+05	5.12e+05	5.12e+02
bis(2-Chloroethyl)ether	7.98	2.51	4.59	6.30	33	5.23e+05	2.00e+05	2.00e+05	2.00e+02
1,4-Dichlorobenzene	6.27	1.59	3.31	2.53	25	5.52e+03	1.10e+04	5.52e+03	5.52e+00
Benzyl alcohol	7.25	2.07	3.81	4.29	31	5.08e+04	3.40e+04	3.40e+04	3.40e+01
1,2-Dichlorobenzene	7.77	2.41	4.59	5.81	33	3.06e+05	1.20e+05	1.20e+05	1.20e+02
2-Methylphenol	8.56	1.74	3.44	3.01	33	6.78e+04	9.00e+04	6.78e+04	6.78e+01
4-Methylphenol	9.28	1.88	3.81	3.52	33	2.21e+05	2.10e+05	2.10e+05	2.10e+02
Isophorone	9.62	3.27	6.20	10.71	33	1.15e+08	3.60e+06	3.60e+06	3.60e+03
2,4-Dimethylphenol	8.95	1.80	3.44	3.25	33	1.16e+05	2.20e+05	1.16e+05	1.16e+02
Benzoic acid	9.57	2.83	5.39	8.02	33	1.17e+07	3.20e+07	1.17e+07	1.17e+04
2,4-Dichlorophenol	5.10	0.44	2.03	0.19	13	2.33e+02	2.00e+02	2.00e+02	2.00e-01
1,2,4-Trichlorobenzene	6.99	2.00	3.81	4.02	29	3.44e+04	7.90e+04	3.44e+04	3.44e+01
Naphthalene	9.78	2.99	5.39	8.95	33	2.68e+07	2.40e+06	2.40e+06	2.40e+03
Hexachlorobutadiene	7.66	2.34	4.59	5.47	33	2.19e+05	1.50e+05	1.50e+05	1.50e+02
2-Methylnaphthalene	9.14	3.08	5.39	9.50	33	2.04e+07	9.90e+05	9.90e+05	9.90e+02
Dimethylphthalate	8.35	2.40	4.59	5.74	33	5.22e+05	7.10e+05	5.22e+05	5.22e+02

Table U - 10

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soils  
Source Area: Offsite Containment Area

Chemical Of Potential Concern	----- 95% UCLM Calculation -----						Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		(ug/kg)	(mg/kg)
Acenaphthylene	5.92	1.27	2.92	1.60	21	1.90e+03	1.10e+04	1.90e+03	1.90e+00
2,6-Dinitrotoluene	5.75	0.86	2.43	0.74	19	7.49e+02	3.50e+03	7.49e+02	7.49e-01
Acenaphthene	7.04	1.95	3.81	3.82	30	3.06e+04	1.80e+04	1.80e+04	1.80e+01
4-Nitrophenol	7.25	0.83	2.31	0.68	19	3.11e+03	1.00e+04	3.11e+03	3.11e+00
Dibenzofuran	6.24	1.47	3.31	2.16	24	4.16e+03	1.10e+04	4.16e+03	4.16e+00
Diethylphthalate	7.63	2.58	4.59	6.67	33	4.70e+05	2.80e+05	2.80e+05	2.80e+02
Fluorene	7.25	2.08	3.81	4.31	31	5.12e+04	3.10e+04	3.10e+04	3.10e+01
N-Nitrosodiphenylamine	7.50	2.14	3.81	4.57	33	7.53e+04	5.30e+04	5.30e+04	5.30e+01
Hexachlorobenzene	6.01	1.22	2.92	1.50	21	1.92e+03	1.10e+04	1.92e+03	1.92e+00
Pentachlorophenol	8.53	2.18	3.81	4.75	31	2.49e+05	1.80e+05	1.80e+05	1.80e+02
Phenanthrene	7.41	2.31	4.59	5.32	33	1.53e+05	4.30e+04	4.30e+04	4.30e+01
Anthracene	5.80	0.78	2.31	0.61	19	6.87e+02	1.30e+03	6.87e+02	6.87e-01
Di-n-butylphthalate	9.42	3.25	5.39	10.59	33	5.43e+07	3.40e+06	3.40e+06	3.40e+03
Fluoranthene	7.01	1.78	3.44	3.17	30	1.68e+04	1.90e+04	1.68e+04	1.68e+01
Pyrene	7.14	1.87	3.44	3.50	30	2.40e+04	2.20e+04	2.20e+04	2.20e+01
Butylbenzylphthalate	9.08	3.14	5.39	9.84	33	2.39e+07	1.60e+06	1.60e+06	1.60e+03
Benzo(a)anthracene	6.94	1.79	3.44	3.20	28	1.67e+04	1.60e+04	1.60e+04	1.60e+01
Chrysene	7.02	1.78	3.44	3.18	29	1.75e+04	2.00e+04	1.75e+04	1.75e+01
bis(2-Ethylhexyl)phthalate	10.62	3.39	6.20	11.51	33	5.33e+08	1.40e+07	1.40e+07	1.40e+04
Di-n-octylphthalate	7.55	2.32	4.59	5.38	33	1.84e+05	1.40e+05	1.40e+05	1.40e+02
Benzo(b)fluoranthene	6.84	1.80	3.72	3.24	26	1.79e+04	1.50e+04	1.50e+04	1.50e+01
Benzo(k)fluoranthene	6.84	1.80	3.72	3.24	26	1.79e+04	1.50e+04	1.50e+04	1.50e+01
Benzo(a)pyrene	6.15	1.23	2.92	1.52	21	2.24e+03	9.70e+03	2.24e+03	2.24e+00
Indeno(1,2,3-cd)pyrene	5.91	0.83	2.31	0.68	19	8.17e+02	1.90e+03	8.17e+02	8.17e-01
Dibenz(a,h)anthracene	5.05	0.45	2.65	0.20	5	3.11e+02	1.90e+02	1.90e+02	1.90e-01
Benzo(g,h,i)perylene	5.77	0.75	2.19	0.56	19	6.23e+02	1.50e+03	6.23e+02	6.23e-01
Alpha-BHC	3.25	1.52	3.08	2.32	35	1.83e+02	3.30e+02	1.83e+02	1.83e-01
Beta-BHC	3.66	1.80	3.44	3.22	40	5.21e+02	8.00e+02	5.21e+02	5.21e-01
Aldrin	3.84	1.94	3.53	3.78	42	8.98e+02	7.70e+03	8.98e+02	8.98e-01
Heptachlor Epoxide	1.66	0.28	1.93	0.08	13	6.35e+00	1.30e+01	6.35e+00	6.35e-03
4,4-DDE	4.03	1.59	3.08	2.52	36	4.50e+02	8.80e+02	4.50e+02	4.50e-01
4,4-DDD	4.44	1.87	3.44	3.51	41	1.35e+03	3.30e+03	1.35e+03	1.35e+00
4,4-DDT	4.30	1.75	3.44	3.06	40	8.91e+02	1.70e+03	8.91e+02	8.91e-01
AROCLOR-1242	6.21	2.11	3.53	4.45	42	1.47e+04	1.90e+05	1.47e+04	1.47e+01
AROCLOR-1248	6.20	2.11	3.53	4.44	42	1.45e+04	3.50e+04	1.45e+04	1.45e+01
AROCLOR-1254	7.69	2.48	4.23	6.16	42	2.46e+05	6.50e+05	2.46e+05	2.46e+02
AROCLOR-1260	7.49	2.44	4.23	5.95	42	1.76e+05	5.60e+05	1.76e+05	1.76e+02

Table U - 10

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soils  
Source Area: Offsite Containment Area

Chemical Of Potential Concern	----- 95% UCLM Calculation -----					Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n		UCLM (95%)	(ug/kg)

Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.
- Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.
- H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)
- Variance = Variance of the natural log of the detected concentration or the 1/2 SQL
- n = Number of data points
- UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT (n-1)))$
- Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.
- Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc. , whichever is lower.
- ERR = Statistical operations cannot be performed on a single data point.

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Table U - 11

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soils  
Source Area: Still Bottoms Treatment Lagoon Area

Chemical of Potential Concern	----- 95% UCLM Calculation -----						Max. Det. Conc. (mg/kg)	Exp. Pnt. Conc. (mg/kg)
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		
Antimony	0.84	1.48	5.18	2.19	8	1.26e+02	4.66e+01	4.66e+01
Barium	4.15	1.40	3.90	1.97	12	8.85e+02	1.56e+03	8.85e+02
Cadmium	0.86	2.06	4.96	4.25	12	4.32e+02	1.18e+02	1.18e+02
Calcium	8.45	1.66	4.42	2.75	12	1.69e+05	5.71e+04	5.71e+04
Chromium, total	3.78	1.62	3.90	2.63	12	1.10e+03	1.41e+03	1.10e+03
Cobalt	2.33	0.81	2.57	0.66	12	2.68e+01	6.30e+01	2.68e+01
Copper	3.53	1.21	3.39	1.46	12	2.44e+02	3.61e+02	2.44e+02
Lead	5.02	1.85	4.42	3.43	12	9.96e+03	6.30e+03	6.30e+03
Magnesium	7.55	1.36	3.39	1.85	12	1.93e+04	1.03e+04	1.03e+04
Mercury	-0.68	1.73	4.42	3.00	12	2.28e+01	1.10e+01	1.10e+01
Nickel	2.40	0.27	1.93	0.07	12	1.33e+01	1.96e+01	1.33e+01
Selenium	-0.42	0.57	2.27	0.33	12	1.15e+00	2.83e+00	1.15e+00
Zinc	4.74	1.57	3.90	2.48	12	2.50e+03	2.28e+03	2.28e+03
Cyanide, total	0.90	1.16	3.39	1.35	12	1.59e+01	7.07e+01	1.59e+01

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc. , whichever is lower.

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Table U - 12

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soil  
Source Area: Still Bottoms - Treatment Lagoon Area

Chemical Of Potential Concern	95% UCLM Calculation					UCLM (95%)	Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	K value	Variance	n			(ug/kg)	(mg/kg)
Methylene Chloride	8.35	2.82	5.39	7.97	28	4.26e+06	3.80e+05	3.80e+05	3.80e+02
Acetone	7.08	2.09	4.96	4.37	13	2.11e+05	1.20e+04	1.20e+04	1.20e+01
1,1-Dichloroethane	6.59	2.45	5.01	5.99	22	2.10e+05	2.20e+04	2.20e+04	2.20e+01
Total 1,2-Dichloroethene	8.31	3.03	5.39	9.20	29	8.86e+06	3.20e+05	3.20e+05	3.20e+02
Chloroform	8.52	3.55	6.20	12.59	29	1.75e+08	2.10e+06	2.10e+06	2.10e+03
1,2-Dichloroethane	7.38	2.63	5.01	6.94	26	7.22e+05	4.00e+04	4.00e+04	4.00e+01
2-Butanone	9.43	2.76	5.39	7.64	29	9.50e+06	5.30e+05	5.30e+05	5.30e+02
1,1,1-Trichloroethane	8.78	3.64	6.20	13.27	29	3.54e+08	2.10e+07	2.10e+07	2.10e+04
Carbon Tetrachloride	7.81	3.35	6.20	11.21	29	3.39e+07	3.60e+06	3.60e+06	3.60e+03
1,2-Dichloropropane	6.47	2.45	5.01	6.01	21	2.03e+05	2.20e+04	2.20e+04	2.20e+01
Trichloroethene	8.80	3.41	6.20	11.63	29	1.22e+08	1.70e+06	1.70e+06	1.70e+03
1,1,2-Trichloroethane	6.14	2.29	5.01	5.26	19	9.67e+04	8.10e+03	8.10e+03	8.10e+00
Benzene	8.21	2.91	5.39	8.46	29	4.85e+06	1.70e+05	1.70e+05	1.70e+02
4-Methyl-2-Pentanone	9.74	2.78	5.39	7.70	29	1.35e+07	1.50e+06	1.50e+06	1.50e+03
Tetrachloroethene	9.61	3.75	6.20	14.03	29	1.34e+09	1.60e+06	1.60e+06	1.60e+03
Toluene	10.89	3.97	7.02	15.78	29	2.79e+10	2.30e+07	2.30e+07	2.30e+04
Chlorobenzene	0.69	ERR	2.75	ERR	1	ERR	2.00e+00	2.00e+00	2.00e-03
Ethylbenzene	10.18	4.04	7.02	16.29	29	1.93e+10	8.40e+06	8.40e+06	8.40e+03
Styrene	7.72	3.09	5.39	9.55	29	6.18e+06	1.60e+05	1.60e+05	1.60e+02
Total Xylenes	11.45	3.99	7.02	15.94	29	5.46e+10	9.40e+06	9.40e+06	9.40e+03
Phenol	7.90	2.09	3.81	4.37	29	1.09e+05	1.70e+05	1.09e+05	1.09e+02
bis(2-Chloroethyl)ether	8.00	2.09	3.81	4.37	29	1.19e+05	1.10e+05	1.10e+05	1.10e+02
2-Chlorophenol	4.87	ERR	2.75	ERR	1	ERR	1.30e+02	1.30e+02	1.30e-01
1,3-Dichlorobenzene	5.57	0.48	2.07	0.23	15	3.85e+02	8.80e+02	3.85e+02	3.85e-01
1,4-Dichlorobenzene	6.16	1.24	2.92	1.54	19	2.39e+03	5.20e+03	2.39e+03	2.39e+00
Benzyl alcohol	5.78	0.76	2.44	0.58	17	6.88e+02	1.60e+03	6.88e+02	6.88e-01
1,2-Dichlorobenzene	7.71	2.14	3.81	4.56	29	1.02e+05	7.00e+04	7.00e+04	7.00e+01
2-Methylphenol	7.07	1.87	3.44	3.48	27	2.35e+04	1.50e+04	1.50e+04	1.50e+01
4-Methylphenol	7.60	1.94	3.81	3.77	28	5.46e+04	4.30e+04	4.30e+04	4.30e+01
Isophorone	9.14	3.28	6.20	10.78	29	9.64e+07	2.60e+06	2.60e+06	2.60e+03
2,4-Dimethylphenol	5.96	1.06	2.74	1.13	17	1.42e+03	2.60e+03	1.42e+03	1.42e+00
Benzoic acid	7.60	1.62	3.61	2.64	17	3.25e+04	5.00e+04	3.25e+04	3.25e+01
2,4-Dichlorophenol	5.94	1.16	2.92	1.36	19	1.68e+03	4.10e+03	1.68e+03	1.68e+00
1,2,4-Trichlorobenzene	6.01	1.09	2.56	1.20	19	1.44e+03	4.30e+03	1.44e+03	1.44e+00
Naphthalene	9.47	2.59	4.59	6.72	29	3.52e+06	7.50e+05	7.50e+05	7.50e+02
Hexachlorobutadiene	7.68	2.01	3.81	4.04	29	6.97e+04	4.00e+04	4.00e+04	4.00e+01
4-Chloro-3-methylphenol	5.48	0.33	1.88	0.11	14	3.01e+02	4.20e+02	3.01e+02	3.01e-01
2-Methylnaphthalene	8.93	2.59	4.59	6.72	29	2.06e+06	3.20e+05	3.20e+05	3.20e+02
2,4,6-Trichlorophenol	5.53	0.43	1.97	0.18	14	3.47e+02	7.50e+02	3.47e+02	3.47e-01
2,4,5-Trichlorophenol	4.56	ERR	2.75	ERR	1	ERR	9.60e+01	9.60e+01	9.60e-02

Table U - 12

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soil  
Source Area: Still Bottoms - Treatment Lagoon Area

Chemical Of Potential Concern	----- 95% UCLM Calculation -----					n	UCLM (95%)	Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	(ug/kg)				(mg/kg)	
2-Chloronaphthalene	5.68	0.66	2.31	0.44	16	5.45e+02	1.80e+03	5.45e+02	5.45e-01	
Dimethylphthalate	8.04	2.63	4.59	6.94	29	9.73e+05	3.20e+05	3.20e+05	3.20e+02	
Acenaphthylene	6.07	1.38	3.31	1.90	19	3.30e+03	1.10e+04	3.30e+03	3.30e+00	
Acenaphthene	6.04	1.30	2.92	1.69	20	2.33e+03	4.80e+03	2.33e+03	2.33e+00	
4-Nitrophenol	7.10	0.33	1.88	0.11	15	1.52e+03	2.30e+03	1.52e+03	1.52e+00	
Dibenzofuran	5.54	0.40	1.97	0.16	15	3.42e+02	6.60e+02	3.42e+02	3.42e-01	
Diethylphthalate	7.53	2.38	4.59	5.68	29	2.52e+05	1.00e+05	1.00e+05	1.00e+02	
Fluorene	6.24	1.53	3.31	2.33	21	5.07e+03	9.80e+03	5.07e+03	5.07e+00	
N-Nitrosodiphenylamine	7.07	1.83	3.44	3.36	27	2.18e+04	1.30e+04	1.30e+04	1.30e+01	
4-Bromophenyl-phenylether	5.87	0.88	2.59	0.77	17	9.23e+02	2.20e+03	9.23e+02	9.23e-01	
Hexachlorobenzene	5.83	0.78	2.31	0.61	18	7.16e+02	2.80e+03	7.16e+02	7.16e-01	
Pentachlorophenol	8.56	1.98	3.81	3.93	29	1.55e+05	6.40e+04	6.40e+04	6.40e+01	
Phenanthrene	6.65	1.65	3.72	2.71	25	1.05e+04	1.00e+04	1.00e+04	1.00e+01	
Anthracene	5.74	0.96	2.74	0.92	17	9.53e+02	3.30e+03	9.53e+02	9.53e-01	
Di-n-butylphthalate	9.07	2.89	5.39	8.38	29	1.10e+07	6.90e+05	6.90e+05	6.90e+02	
Fluoranthene	5.67	0.76	2.44	0.57	17	6.10e+02	1.70e+03	6.10e+02	6.10e-01	
Pyrene	5.94	1.17	2.92	1.38	19	1.70e+03	4.70e+03	1.70e+03	1.70e+00	
Butylbenzylphthalate	9.03	2.98	5.39	8.87	29	1.46e+07	9.60e+05	9.60e+05	9.60e+02	
Benzo(a)anthracene	5.52	0.36	1.97	0.13	15	3.21e+02	4.60e+02	3.21e+02	3.21e-01	
Chrysene	5.48	0.31	1.88	0.10	15	2.96e+02	4.60e+02	2.96e+02	2.96e-01	
bis(2-Ethylhexyl)phthalat	10.60	2.89	5.39	8.35	29	4.95e+07	2.60e+06	2.60e+06	2.60e+03	
Di-n-octylphthalate	6.88	1.86	3.44	3.47	27	1.95e+04	2.40e+04	1.95e+04	1.95e+01	
Benzo(b)fluoranthene	5.54	0.34	1.88	0.12	16	3.20e+02	4.60e+02	3.20e+02	3.20e-01	
Benzo(k)fluoranthene	5.54	0.34	1.88	0.12	16	3.20e+02	4.60e+02	3.20e+02	3.20e-01	
Benzo(a)pyrene	5.31	0.09	1.80	0.01	11	2.15e+02	2.60e+02	2.15e+02	2.15e-01	
Gamma-BHC (Lindane)	3.87	1.83	3.72	3.34	19	1.27e+03	1.10e+03	1.10e+03	1.10e+00	
Endosulfan 1	3.88	1.84	3.72	3.37	19	1.30e+03	1.20e+03	1.20e+03	1.20e+00	
4,4-DDT	5.24	2.48	5.01	6.16	21	6.59e+04	2.80e+04	2.80e+04	2.80e+01	
Endrin Ketone	3.83	1.45	3.61	2.11	14	5.67e+02	2.60e+02	2.60e+02	2.60e-01	
AROCLOR-1248	6.80	2.48	5.01	6.16	21	3.16e+05	7.60e+04	7.60e+04	7.60e+01	
AROCLOR-1254	7.30	2.06	4.14	4.24	20	8.70e+04	4.70e+04	4.70e+04	4.70e+01	
AROCLOR-1260	7.16	1.99	4.14	3.95	20	6.14e+04	3.50e+04	3.50e+04	3.50e+01	

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL  
 n = Number of data points

Table U - 12

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Soil  
Source Area: Still Bottoms - Treatment Lagoon Area

Chemical Of Potential Concern	----- 95% UCLM Calculation -----					Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n		UCLM (95%)	(ug/kg)

UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std\ Dev. * H\ value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.  
 ERR = Statistical operations cannot be performed on a single data point.

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Table U - 13

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Surface Soils  
Source Area: Kapica Pazmey

Chemical of Potential Concern	----- 95% UCLM Calculation -----						Max. Det. Conc. (mg/kg)	Exp. Pnt. Conc. (mg/kg)
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		
Aluminum	8.80	0.64	7.81	0.41	4	1.48e+05	1.32e+04	1.32e+04
Antimony	3.62	1.01	13.05	1.02	4	1.23e+05	8.48e+01	8.48e+01
Barium	7.15	1.73	22.87	2.98	4	4.51e+13	5.73e+03	5.73e+03
Cadmium	4.15	1.70	22.87	2.90	4	1.58e+12	1.74e+02	1.74e+02
Calcium	9.95	1.63	22.87	2.66	4	1.75e+14	1.57e+05	1.57e+05
Chromium, total	6.55	1.63	22.87	2.64	4	5.46e+12	3.08e+03	3.08e+03
Cobalt	3.62	1.39	19.60	1.94	4	6.97e+08	1.48e+02	1.48e+02
Copper	6.65	1.41	19.60	1.99	4	1.77e+10	4.47e+03	4.47e+03
Iron	9.69	1.00	13.05	0.99	4	4.85e+07	7.01e+04	7.01e+04
Lead	8.41	1.66	22.87	2.77	4	6.20e+13	1.62e+04	1.62e+04
Magnesium	8.48	1.75	22.87	3.06	4	2.38e+14	3.69e+04	3.69e+04
Manganese	6.13	1.06	13.05	1.12	4	2.37e+06	1.54e+03	1.54e+03
Mercury	1.32	1.83	22.87	3.34	4	6.07e+11	9.50e+00	9.50e+00
Nickel	3.72	1.21	16.33	1.46	4	7.58e+06	1.97e+02	1.97e+02
Selenium	1.79	1.06	13.05	1.12	4	3.09e+04	1.72e+01	1.72e+01
Silver	1.76	1.32	16.33	1.75	4	3.69e+06	2.48e+01	2.48e+01
Vanadium	2.97	0.73	9.12	0.53	4	1.19e+03	4.77e+01	4.77e+01
Zinc	8.29	1.87	22.87	3.51	4	1.28e+15	1.58e+04	1.58e+04
Cyanide, total	3.15	1.19	16.33	1.42	4	3.64e+06	6.62e+01	6.62e+01

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc. , whichever is lower.

Table U - 14

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Surface Soil  
Source Area: Kapica Pazney

Chemical Of Potential Concern	----- 95% UCLM Calculation -----						Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		(ug/kg)	(mg/kg)
Methylene Chloride	5.30	ERR	2.75	ERR	1	ERR	2.00e+02	2.00e+02	2.00e-01
Acetone	5.73	1.04	13.05	1.07	3	7.43e+06	9.70e+02	9.70e+02	9.70e-01
1,1-Dichloroethane	4.72	0.28	4.11	0.08	3	2.63e+02	1.50e+02	1.50e+02	1.50e-01
Total 1,2-Dichloroethene	5.92	2.95	39.23	8.69	3	ERR	7.60e+03	7.60e+03	7.60e+00
Chloroform	2.30	ERR	2.75	ERR	1	ERR	1.00e+01	1.00e+01	1.00e-02
1,1,1-Trichloroethane	2.20	ERR	2.75	ERR	1	ERR	9.00e+00	9.00e+00	9.00e-03
1,2-Dichloropropane	2.94	ERR	2.75	ERR	1	ERR	1.90e+01	1.90e+01	1.90e-02
Trichloroethene	7.93	4.66	58.85	21.68	4	ERR	1.70e+05	1.70e+05	1.70e+02
Benzene	6.54	1.33	16.33	1.77	3	7.74e+09	3.20e+03	3.20e+03	3.20e+00
4-Methyl-2-Pentanone	6.96	3.91	52.31	15.32	4	ERR	2.70e+05	2.70e+05	2.70e+02
Tetrachloroethene	9.09	4.55	58.85	20.72	4	ERR	7.90e+05	7.90e+05	7.90e+02
Toluene	11.54	4.67	58.85	21.84	4	ERR	1.90e+07	1.90e+07	1.90e+04
Chlorobenzene	5.74	3.01	39.23	9.07	3	ERR	6.20e+03	6.20e+03	6.20e+00
Ethylbenzene	10.44	4.07	52.31	16.57	4	ERR	4.30e+06	4.30e+06	4.30e+03
Styrene	6.17	3.68	45.77	13.57	3	ERR	2.30e+04	2.30e+04	2.30e+01
Total Xylenes	12.39	3.57	45.77	12.73	4	ERR	2.30e+07	2.30e+07	2.30e+04
Phenol	7.70	2.23	26.14	4.97	4	1.10e+19	2.80e+04	2.80e+04	2.80e+01
1,2-Dichlorobenzene	5.89	0.55	6.50	0.30	3	5.20e+03	5.90e+02	5.90e+02	5.90e-01
2-Methylphenol	6.80	1.43	19.60	2.04	3	1.01e+12	4.70e+03	4.70e+03	4.70e+00
4-Methylphenol	6.62	1.59	19.60	2.54	3	1.05e+13	4.60e+03	4.60e+03	4.60e+00
Isophorone	9.46	2.08	26.14	4.33	4	4.92e+18	9.70e+04	9.70e+04	9.70e+01
2,4-Dimethylphenol	7.21	1.27	16.33	1.60	3	6.73e+09	4.90e+03	4.90e+03	4.90e+00
Naphthalene	9.36	2.11	26.14	4.45	4	7.30e+18	9.70e+04	9.70e+04	9.70e+01
2-Methylnaphthalene	8.85	2.05	26.14	4.19	4	1.51e+18	5.60e+04	5.60e+04	5.60e+01
2,4,5-Trichlorophenol	5.14	ERR	2.75	ERR	1	ERR	1.70e+02	1.70e+02	1.70e-01
Dimethylphthalate	6.40	0.73	9.12	0.53	3	8.75e+04	1.40e+03	1.40e+03	1.40e+00
Acenaphthene	5.89	ERR	2.75	ERR	1	ERR	3.60e+02	3.60e+02	3.60e-01
Dibenzofuran	5.97	0.13	2.75	0.02	2	5.60e+02	4.30e+02	4.30e+02	4.30e-01
Diethylphthalate	6.77	1.58	19.60	2.49	4	1.76e+11	5.00e+03	5.00e+03	5.00e+00
Fluorene	6.33	0.16	3.30	0.02	3	8.18e+02	6.20e+02	6.20e+02	6.20e-01
N-Nitrosodiphenylamine	7.30	1.21	16.33	1.46	3	3.45e+09	4.30e+03	4.30e+03	4.30e+00
Pentachlorophenol	6.64	0.95	11.74	0.91	2	8.65e+07	1.50e+03	1.50e+03	1.50e+00
Phenanthrene	7.28	1.09	13.05	1.19	4	9.70e+06	4.30e+03	4.30e+03	4.30e+00
Anthracene	6.23	0.37	5.22	0.14	2	3.79e+03	6.60e+02	6.60e+02	6.60e-01
Di-n-butylphthalate	10.11	0.95	11.74	0.90	4	2.37e+07	9.40e+04	9.40e+04	9.40e+01
Fluoranthene	7.46	0.76	10.43	0.58	3	6.26e+05	3.40e+03	3.40e+03	3.40e+00
Pyrene	7.50	0.30	4.11	0.09	3	4.50e+03	2.30e+03	2.30e+03	2.30e+00
Butylbenzylphthalate	8.65	2.12	26.14	4.51	4	4.50e+18	5.10e+04	5.10e+04	5.10e+01
Benzo(a)anthracene	7.38	0.55	6.50	0.31	3	2.37e+04	2.40e+03	2.40e+03	2.40e+00
Chrysene	7.17	0.00	2.75	0.00	2	1.30e+03	1.30e+03	1.30e+03	1.30e+00

Table U - 14

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Surface Soil  
Source Area: Kapica Pazmey

Chemical Of Potential Concern	----- 95% UCLM Calculation -----					n	UCLM (95%)	Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	(ug/kg)				(mg/kg)	
bis(2-Ethylhexyl)phthalate	12.59	0.70	9.12	0.49	4	1.52e+07	5.40e+05	5.40e+05	5.40e+02	
Di-n-octylphthalate	8.18	2.01	26.14	4.03	4	3.76e+17	3.80e+04	3.80e+04	3.80e+01	
Benzo(b)fluoranthene	7.31	1.13	13.05	1.28	3	9.64e+07	3.90e+03	3.90e+03	3.90e+00	
Benzo(k)fluoranthene	7.31	1.13	13.05	1.28	3	9.64e+07	3.90e+03	3.90e+03	3.90e+00	
Benzo(a)pyrene	6.62	0.89	11.74	0.78	2	3.64e+07	1.40e+03	1.40e+03	1.40e+00	
Indeno(1,2,3-cd)pyrene	6.35	0.51	6.50	0.26	2	1.76e+04	8.20e+02	8.20e+02	8.20e-01	
Dibenz(a,h)anthracene	5.60	ERR	2.75	ERR	1	ERR	2.70e+02	2.70e+02	2.70e-01	
Benzo(g,h,i)perylene	6.50	0.72	9.12	0.51	2	5.83e+05	1.10e+03	1.10e+03	1.10e+00	
Aldrin	3.18	1.10	3.10	1.22	9	1.48e+02	8.80e+01	8.80e+01	8.80e-02	
Endosulfan 1	2.64	0.93	4.48	0.86	6	1.39e+02	4.20e+01	4.20e+01	4.20e-02	
4,4-DDD	3.56	1.01	3.70	1.03	8	2.44e+02	1.50e+02	1.50e+02	1.50e-01	
AROCLOR-1242	7.01	2.63	5.56	6.89	16	1.51e+06	2.80e+05	2.80e+05	2.80e+02	
AROCLOR-1248	6.52	1.99	4.56	3.97	15	5.62e+04	2.70e+04	2.70e+04	2.70e+01	
AROCLOR-1254	7.24	1.95	4.56	3.82	15	1.02e+05	2.20e+04	2.20e+04	2.20e+01	

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL.  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.  
 ERR = Statistical operations cannot be performed on a single data point.

Table U - 15

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Sub-surface Soils  
Source Area: Kapica Pazmey

Chemical of Potential Concern	95% UCLM Calculation						Max. Det. Conc. (mg/kg)	Exp. Pnt. Conc. (mg/kg)
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		
Antimony	2.38	ERR	2.75	ERR	1	ERR	1.08e+01	1.08e+01
Barium	4.13	2.12	26.14	4.49	4	4.61e+16	1.49e+03	1.49e+03
Cadmium	-0.68	2.94	39.23	8.62	4	2.87e+30	4.04e+01	4.04e+01
Chromium, total	3.06	2.58	32.69	6.65	4	8.16e+23	1.01e+03	1.01e+03
Cobalt	1.89	0.40	5.22	0.16	4	2.38e+01	1.20e+01	1.20e+01
Copper	2.13	2.69	32.69	7.24	4	3.57e+24	4.78e+02	4.78e+02
Lead	3.63	3.18	39.23	10.10	4	1.06e+35	4.06e+03	4.06e+03
Magnesium	6.49	1.44	19.60	2.08	4	2.32e+10	5.17e+03	5.17e+03
Mercury	-2.24	2.11	26.14	4.46	4	6.81e+13	2.30e+00	2.30e+00
Selenium	-1.03	0.96	13.05	0.92	4	7.79e+02	1.50e+00	1.50e+00
Silver	1.09	2.05	26.14	4.20	4	6.69e+14	6.43e+01	6.43e+01
Zinc	4.95	2.34	32.69	5.48	4	3.34e+22	2.20e+03	2.20e+03
Cyanide, total	1.02	1.36	19.60	1.85	4	3.41e+07	2.13e+01	2.13e+01

Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.
- Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.
- H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)
- Variance = Variance of the natural log of the detected concentration or the 1/2 SQL.
- n = Number of data points
- UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std. Dev. * H value) / SQRT(n-1)))$
- Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.
- Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.
- ERR = Statistical operations cannot be performed on a single data point

Table U - 16

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Sub surface soil  
Source Area: Kapica Pazmey

Chemical Of Potential Concern	95% UCLM Calculation						Max. Det. Conc.	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)	(ug/kg)	(ug/kg)	(mg/kg)
Chloroethane	1.93	0.27	1.98	0.07	10	8.57e+00	1.20e+01	8.57e+00	8.57e-03
Acetone	4.44	2.40	6.07	5.77	13	1.02e+05	8.70e+03	8.70e+03	8.70e+00
Carbon Disulfide	1.04	0.03	2.04	0.00	6	2.91e+00	3.00e+00	2.91e+00	2.91e-03
1,1-Dichloroethane	2.44	2.24	4.96	5.01	12	4.00e+03	7.90e+02	7.90e+02	7.90e-01
Total 1,2-Dichloroethene	4.02	3.51	7.60	12.33	16	2.59e+07	2.60e+04	2.60e+04	2.60e+01
Chloroform	0.70	0.54	2.95	0.29	6	4.75e+00	3.00e+00	3.00e+00	3.00e-03
1,2-Dichloroethane	1.43	0.85	2.71	0.72	10	1.29e+01	4.40e+01	1.29e+01	1.29e-02
2-Butanone	4.95	3.47	7.60	12.02	16	5.13e+07	9.00e+04	9.00e+04	9.00e+01
1,1,1-Trichloroethane	2.26	2.03	4.96	4.12	12	1.56e+03	5.60e+02	5.60e+02	5.60e-01
1,2-Dichloropropane	1.40	0.78	2.71	0.61	10	1.12e+01	3.50e+01	1.12e+01	1.12e-02
Trichloroethene	4.14	4.00	8.63	16.03	16	1.41e+09	2.50e+05	2.50e+05	2.50e+02
Benzene	3.49	3.30	7.60	10.86	15	6.01e+06	2.30e+04	2.30e+04	2.30e+01
4-Methyl-2-Pentanone	3.62	2.65	6.07	7.01	13	1.29e+05	4.20e+03	4.20e+03	4.20e+00
2-Hexanone	2.23	1.33	3.64	1.78	10	1.15e+02	3.90e+02	1.15e+02	1.15e-01
Tetrachloroethene	4.29	4.26	9.67	18.18	16	2.72e+10	2.40e+05	2.40e+05	2.40e+02
Toluene	5.83	5.30	10.71	26.08	16	9.87e+14	1.40e+06	1.40e+06	1.40e+03
Chlorobenzene	4.05	3.27	7.60	10.70	16	7.42e+06	2.70e+04	2.70e+04	2.70e+01
Ethylbenzene	5.41	4.64	9.67	21.50	16	1.11e+12	5.70e+05	5.70e+05	5.70e+02
Styrene	4.04	3.73	7.60	13.92	16	9.07e+07	2.60e+05	2.60e+05	2.60e+02
Total Xylenes	7.41	4.50	9.67	20.22	16	3.05e+12	1.70e+06	1.70e+06	1.70e+03
Phenol	6.46	2.37	32.69	5.61	4	2.69e+23	9.60e+03	9.60e+03	9.60e+00
1,2-Dichlorobenzene	5.24	0.21	3.30	0.05	4	2.90e+02	2.60e+02	2.60e+02	2.60e-01
2-Methylphenol	5.68	1.79	22.87	3.20	4	2.63e+13	4.10e+03	4.10e+03	4.10e+00
4-Methylphenol	5.15	1.84	22.87	3.38	4	3.22e+13	2.40e+03	2.40e+03	2.40e+00
Isophorone	7.18	2.81	39.23	7.87	4	2.70e+32	6.50e+04	6.50e+04	6.50e+01
2,4-Dimethylphenol	5.07	1.87	22.87	3.51	4	5.12e+13	2.20e+03	2.20e+03	2.20e+00
Benzoic acid	5.39	1.10	13.05	1.21	3	1.00e+07	7.00e+02	7.00e+02	7.00e-01
Naphthalene	6.14	2.67	32.69	7.14	4	1.33e+26	2.30e+04	2.30e+04	2.30e+01
2-Methylnaphthalene	6.41	2.20	26.14	4.83	4	1.72e+18	1.60e+04	1.60e+04	1.60e+01
Dimethylphthalate	6.05	1.82	22.87	3.32	4	6.23e+13	6.50e+03	6.50e+03	6.50e+00
Acenaphthene	5.49	0.71	9.12	0.51	4	1.35e+04	7.10e+02	7.10e+02	7.10e-01
4-Nitrophenol	6.53	1.75	22.87	3.06	4	3.47e+13	4.60e+03	4.60e+03	4.60e+00
Dibenzofuran	5.25	0.91	11.74	0.82	4	1.34e+05	6.40e+02	6.40e+02	6.40e-01
2,4-Dinitrotoluene	5.54	0.80	10.43	0.64	4	4.28e+04	8.40e+02	8.40e+02	8.40e-01
Diethylphthalate	5.64	1.02	13.05	1.03	4	1.01e+06	1.30e+03	1.30e+03	1.30e+00
Fluorene	5.36	0.90	11.74	0.81	4	1.41e+05	7.60e+02	7.60e+02	7.60e-01
Pentachlorophenol	6.74	2.40	32.69	5.75	4	6.80e+23	1.60e+04	1.60e+04	1.60e+01
Phenanthrene	6.04	1.63	22.87	2.66	4	3.61e+12	4.80e+03	4.80e+03	4.80e+00
Anthracene	5.55	0.83	10.43	0.69	4	5.29e+04	8.90e+02	8.90e+02	8.90e-01
Di-n-butylphthalate	5.63	2.85	39.23	8.15	4	1.93e+32	1.90e+04	1.90e+04	1.90e+01

Table U - 16

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Sub surface soil  
Source Area: Kapica Pazmey

Chemical Of Potential Concern	----- 95% UCLM Calculation -----						Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		(ug/kg)	(mg/kg)
Fluoranthene	5.66	2.13	26.14	4.56	4	2.77e+17	6.00e+03	6.00e+03	6.00e+00
Pyrene	5.72	1.80	22.87	3.23	4	3.08e+13	4.20e+03	4.20e+03	4.20e+00
Butylbenzylphthalate	6.33	2.38	32.69	5.68	4	3.32e+23	2.00e+04	2.00e+04	2.00e+01
Benzo(a)anthracene	5.76	1.26	16.33	1.58	4	9.84e+07	2.10e+03	2.10e+03	2.10e+00
Chrysene	5.68	1.09	13.05	1.19	4	1.93e+06	1.50e+03	1.50e+03	1.50e+00
bis(2-Ethylhexyl)phthalate	7.85	2.84	39.23	8.08	4	1.32e+33	1.10e+05	1.10e+05	1.10e+02
Di-n-octylphthalate	6.29	1.44	19.60	2.07	4	1.76e+10	3.30e+03	3.30e+03	3.30e+00
Benzo(b)fluoranthene	5.78	1.28	16.33	1.64	4	1.28e+08	2.20e+03	2.20e+03	2.20e+00
Benzo(k)fluoranthene	5.78	1.28	16.33	1.64	4	1.28e+08	2.20e+03	2.20e+03	2.20e+00
Benzo(a)pyrene	5.46	0.64	7.81	0.41	4	5.11e+03	6.10e+02	6.10e+02	6.10e-01
Benzo(g,h,i)perylene	5.24	0.21	3.30	0.05	4	2.90e+02	2.60e+02	2.60e+02	2.60e-01
AROCLOR-1242	5.92	2.34	5.56	5.48	16	1.66e+05	3.40e+04	3.40e+04	3.40e+01
AROCLOR-1248	5.54	1.80	4.08	3.23	16	8.51e+03	9.60e+03	8.51e+03	8.51e+00
AROCLOR-1254	6.29	2.06	4.56	4.22	16	5.03e+04	1.60e+04	1.60e+04	1.60e+01

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.  
 ERR = Statistical operations cannot be performed on a single data point.

Table U - 17

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Sediments  
Source Area: ACS

Chemical of Potential Concern	----- 95% UCLM Calculation -----						Max. Det. Conc. (mg/kg)	Exp. Pnt. Conc. (mg/kg)
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	UCLM (95%)		
Barium	3.91	0.48	1.99	0.23	18	7.12e+01	1.07e+02	7.12e+01
Calcium	8.73	1.40	3.61	1.97	18	5.62e+04	7.30e+04	5.62e+04
Chromium, Total	2.79	0.94	2.59	0.88	18	4.54e+01	2.73e+02	4.54e+01
Copper	2.93	1.19	3.16	1.41	18	9.44e+01	3.59e+02	9.44e+01
Magnesium	7.57	1.42	3.61	2.03	18	1.86e+04	2.23e+04	1.86e+04
Mercury	-2.42	1.58	3.61	2.48	18	1.22e+00	8.80e+00	1.22e+00
Nickel	2.39	0.70	2.31	0.49	18	2.06e+01	4.05e+01	2.06e+01
Selenium	-0.94	0.51	2.07	0.26	18	5.73e-01	1.10e+00	5.73e-01
Vanadium	2.76	0.79	2.44	0.63	18	3.45e+01	4.79e+01	3.45e+01

## Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.  
 Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.  
 H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)  
 Variance = Variance of the natural log of the detected concentration or the 1/2 SQL.  
 n = Number of data points  
 UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std. Dev. * H value) / SQRT(n-1)))$   
 Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.  
 Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc., whichever is lower.

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Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Sediment  
Source Area: ACS

Chemical Of Potential Concern	----- 95% UCLM Calculation -----					UCLM (95%)	Max. Det. Conc. (ug/kg)	----- Exposure Point Conc. -----	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n			(ug/kg)	(mg/kg)
Chloroethane	2.25	0.31	1.88	0.10	17	1.16e+01	2.20e+01	1.16e+01	1.16e-02
Methylene Chloride	2.73	0.60	2.18	0.36	16	2.58e+01	4.40e+01	2.58e+01	2.58e-02
Total 1,2-Dichloroethene	1.53	0.32	1.83	0.10	18	5.60e+00	1.10e+01	5.60e+00	5.60e-03
Chloroform	1.40	0.51	2.07	0.26	18	5.93e+00	1.10e+01	5.93e+00	5.93e-03
2-Butanone	2.10	0.15	1.75	0.02	15	8.86e+00	1.10e+01	8.86e+00	8.86e-03
1,1,1-Trichloroethane	1.10	ERR	2.75	ERR	1	ERR	3.00e+00	3.00e+00	3.00e-03
Benzene	2.04	1.94	4.56	3.76	18	4.30e+02	1.40e+04	4.30e+02	4.30e-01
Toluene	2.13	1.26	3.16	1.59	18	4.89e+01	1.70e+02	4.89e+01	4.89e-02
Ethylbenzene	1.71	0.85	2.44	0.73	18	1.31e+01	1.30e+02	1.31e+01	1.31e-02
Total Xylenes	1.73	0.95	2.59	0.90	18	1.60e+01	2.00e+02	1.60e+01	1.60e-02
Phenol	4.65	0.84	10.43	0.70	2	9.43e+05	1.90e+02	1.90e+02	1.90e-01
bis(2-Chloroethyl)ether	5.71	0.29	1.88	0.08	17	3.61e+02	5.60e+02	3.61e+02	3.61e-01
bis(2-Chloroisopropyl)ether	5.87	0.59	2.18	0.35	18	5.77e+02	1.80e+03	5.77e+02	5.77e-01
4-Methylphenol	5.42	0.28	1.98	0.08	11	2.79e+02	2.70e+02	2.70e+02	2.70e-01
2,4-Dimethylphenol	5.71	0.30	1.88	0.09	17	3.62e+02	6.10e+02	3.62e+02	3.62e-01
Benzoic acid	6.51	0.70	2.41	0.48	12	1.42e+03	1.20e+03	1.20e+03	1.20e+00
Naphthalene	5.46	0.54	2.07	0.29	17	3.57e+02	4.20e+02	3.57e+02	3.57e-01
2-Methylnaphthalene	5.42	0.51	2.07	0.26	15	3.41e+02	4.60e+02	3.41e+02	3.41e-01
Dibenzofuran	5.42	0.02	2.04	0.00	5	2.32e+02	2.30e+02	2.30e+02	2.30e-01
Fluorene	5.64	0.46	2.07	0.21	18	3.95e+02	7.50e+02	3.95e+02	3.95e-01
Hexachlorobenzene	4.94	ERR	2.75	ERR	1	ERR	1.40e+02	1.40e+02	1.40e-01
Pentachlorophenol	4.64	1.12	13.05	1.26	2	4.51e+08	2.30e+02	2.30e+02	2.30e-01
Phenanthrene	5.48	0.56	2.18	0.31	18	3.77e+02	6.60e+02	3.77e+02	3.77e-01
Anthracene	4.51	0.13	2.75	0.02	2	1.32e+02	1.00e+02	1.00e+02	1.00e-01
Di-n-butylphthalate	4.63	0.45	5.22	0.20	4	4.44e+02	1.70e+02	1.70e+02	1.70e-01
Fluoranthene	5.63	0.70	2.31	0.49	18	5.24e+02	1.00e+03	5.24e+02	5.24e-01
Pyrene	5.59	0.69	2.31	0.47	18	5.00e+02	1.10e+03	5.00e+02	5.00e-01
Butylbenzylphthalate	5.11	0.04	2.75	0.00	2	1.86e+02	1.70e+02	1.70e+02	1.70e-01
Benzo(a)anthracene	5.55	0.63	2.18	0.39	14	4.57e+02	7.10e+02	4.57e+02	4.57e-01
Chrysene	5.55	0.61	2.18	0.37	18	4.29e+02	8.00e+02	4.29e+02	4.29e-01
bis(2-Ethylhexyl)phthalate	6.28	1.40	3.61	1.97	17	5.07e+03	1.30e+04	5.07e+03	5.07e+00
Benzo(b)fluoranthene	5.50	0.88	2.59	0.77	18	6.24e+02	1.50e+03	6.24e+02	6.24e-01
Benzo(k)fluoranthene	5.52	0.88	2.59	0.77	18	6.36e+02	1.50e+03	6.36e+02	6.36e-01
Benzo(a)pyrene	5.58	0.56	2.18	0.32	18	4.18e+02	6.90e+02	4.18e+02	4.18e-01
Indeno(1,2,3-cd)pyrene	5.62	0.26	1.88	0.07	17	3.24e+02	4.20e+02	3.24e+02	3.24e-01
Dibenz(a,h)anthracene	4.90	0.51	6.50	0.26	3	1.62e+03	2.00e+02	2.00e+02	2.00e-01
Benzo(g,h,i)perylene	5.70	0.30	1.88	0.09	18	3.59e+02	5.50e+02	3.59e+02	3.59e-01
Heptachlor Epoxide	2.44	0.83	2.44	0.69	18	2.65e+01	6.60e+01	2.66e+01	2.66e-02
AROCLOR-1248	4.78	1.15	3.16	1.32	18	5.53e+02	4.60e+03	5.53e+02	5.53e-01

Table U - 18

Determination of Exposure Point Concentration:  
95% UCLM vs Maximum Detected Concentration

Media: Sediment  
Source Area: ACS

Chemical Of Potential Concern	----- 95% UCLM Calculation -----						UCLM (95%)	Max. Det. Conc. (ug/kg)	Exposure Point Conc.	
	Ave. of LN Data	Std Dev. of LN Data	H value	Variance	n	(ug/kg)			(mg/kg)	(mg/kg)
AROCLOR-1254	5.88	1.41	3.61	2.00	18	3.34e+03	1.70e+04	3.34e+03	3.34e+00	
AROCLOR-1260	5.09	0.36	2.03	0.13	13	2.13e+02	2.90e+02	2.13e+02	2.13e-01	

Notes:

- Ave. of LN Data = The arithmetic mean of the natural logs of the detected concentration or the 1/2 SQL.
- Std Dev. of LN Data = The standard deviation of the natural log of the detected concentration or the 1/2 SQL.
- H Value = H statistic for computing a one-sided upper 95% confidence limit on a lognormal mean (Gilbert 1987, table A12)
- Variance = Variance of the natural log of the detected concentration or the 1/2 SQL
- n = Number of data points
- UCLM (95%) =  $EXP(Ave. + 0.5 * Variance + ((Std Dev. * H value) / SQRT (n-1)))$
- Max. Det. Conc. = Maximum detected concentration of the chemical in the Source Area sample group.
- Exposure Point Conc. = The 95% UCLM or the Max. Det. Conc. , whichever is lower.
- ERR = Statistical operations cannot be performed on a single data point.

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TABLE U-19

## CS GROUNDWATERS - UPPER AQUIFER

PARAMETER (UG/L)	ARITHMETIC MEAN	n	STD	C-O-V	PARAMETER (UG/L)	ARITHMETIC MEAN	n	STD	C-O-V
Chloromethane	1.26e+01	22	1.65e+01	130.70	Arsenic	9.33e+00	25	1.10e+01	117.70
Vinyl Chloride	5.93e+01	22	1.68e+02	282.80	Barium	4.12e+02	25	4.81e+02	116.73
Chloroethane	3.12e+02	23	6.17e+02	197.70	Beryllium	1.00e-01	25	0.00e+00	0.00
Ethylene Chloride	4.65e+01	22	1.04e+02	224.19	Cadmium	2.99e-01	25	6.18e-01	206.57
Acetone	8.33e+03	22	2.70e+04	324.44	Chromium, Total	9.06e-01	25	9.10e-01	100.42
1,1-Dichloroethane	2.43e+02	23	6.47e+02	265.82	Lead	1.69e+00	25	6.95e-01	41.05
Total 1,2-Dichloroethene	3.95e+01	22	9.90e+01	250.45	Manganese	1.90e+03	25	1.51e+03	79.44
-Butanone	2.20e+04	17	6.26e+04	285.15	Mercury	2.36e-01	25	3.14e-01	133.09
Trichloroethene	6.95e+00	21	1.03e+01	148.05	Nickel	2.36e+01	25	9.87e+00	41.91
Benzene	4.74e+03	23	2.08e+04	438.39	Selenium	1.25e+00	25	1.05e+00	84.19
-Methyl-2-Pentanone	4.38e+03	23	1.43e+04	326.38	Sodium	1.24e+05	25	1.39e+05	112.27
-Hexanone	1.46e+02	22	4.48e+02	307.73	Thallium	1.86e+00	25	6.61e-01	35.48
Tetrachloroethene	1.94e+01	22	4.81e+01	248.15	Vanadium	4.20e+00	25	6.03e+00	143.61
Toluene	1.30e+02	23	4.80e+02	368.41	Zinc	9.67e+01	25	2.02e+02	208.78
Chlorobenzene	1.16e+01	21	2.33e+01	200.55	Cyanide, Total	5.20e+00	25	1.00e+00	19.23
Thylbenzene	1.35e+02	23	3.11e+02	230.05	Aluminum	2.08e+02	25	2.25e+01	10.84
Total Xylenes	1.95e+02	23	6.29e+02	323.10	Calcium	1.65e+05	25	1.94e+05	117.52
Phenol	1.77e+01	23	4.90e+01	277.14	Iron	2.21e+04	25	5.25e+04	237.48
Bis(2-Chloroethyl)ether	2.87e+01	23	6.20e+01	215.88	Magnesium	3.14e+04	25	1.86e+04	59.11
1,3-Dichlorobenzene	3.00e+00	1			Potassium	1.33e+04	25	2.39e+04	180.07
1,4-Dichlorobenzene	5.09e+00	23	1.24e+00	24.38					
1,2-Dichlorobenzene	8.57e+00	23	8.25e+00	96.26					
-Methylphenol	6.81e+00	21	7.39e+00	108.57					
Bis(2-Chloroisopropyl)ether	3.50e+01	23	7.14e+01	203.86					
-Methylphenol	1.15e+02	21	4.78e+02	414.80					
Sophorone	7.78e+00	23	7.74e+00	99.45					
1,4-Dimethylphenol	1.02e+01	21	2.29e+01	224.52					
Benzoic acid	1.02e+02	23	3.92e+02	384.87					
Naphthalene	1.23e+01	23	1.96e+01	159.44					
-Chloro-3-methylphenol	3.50e+00	2	2.12e+00	60.61					
-Methylnaphthalene	6.57e+00	23	4.97e+00	75.72					
Diethylphthalate	5.09e+00	23	9.49e-01	18.66					
Orthochlorophenol	2.50e+00	2	7.07e-01	28.28					
Di-n-butylphthalate	2.00e+00	1							
Bis(2-Ethylhexyl)phthalate	7.83e+00	23	1.06e+01	134.99					
ROCLOR-1248	3.52e-01	23	4.90e-01	139.14					
ROCLOR-1260	1.65e+00	23	5.53e+00	334.45					

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TABLE U-19

## CS GROUNDWATERS - LOWER AQUIFER

PARAMETER (UG/L)	ARITHMETIC MEAN	n	STD	C-O-V
Chloroethane	7.48e+01	9	1.51e+02	202.50
1,2-Dichloroethane	3.00e+00	1		
Di(2-Chloroethyl)ether	6.44e+00	9	2.88e+00	44.64
Arsenic	3.09e+00	8	2.41e+00	78.07
Barium	1.78e+02	8	8.70e+01	49.00
Boron	9.93e+04	8	4.20e+04	42.30
Copper	1.13e+01	8	3.54e+00	31.43
Iron	8.19e+02	8	1.20e+03	146.83
Magnesium	3.05e+04	8	1.56e+04	51.32
Manganese	2.78e+02	8	2.68e+02	96.39
Mercury	2.09e-01	8	1.15e-01	55.00
Potassium	1.72e+03	8	9.53e+02	55.35
Selenium	2.00e+00	8	0.00e+00	0.00
Sodium	3.38e+04	8	2.96e+04	87.61
Zinc	1.35e+00	8	5.53e-01	40.96
	7.75e+00	8	6.02e+00	77.65

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TABLE U-19

CS OFFSITE

PARAMETER (UG/KG)	ARITHMETIC MEAN	n	STD	C-O-V	PARAMETER (UG/KG)	ARITHMETIC MEAN	n	STD	C-O-V
vinyl Chloride	6.02e+02	23	7.99e+02	132.62	Phenol	6.94e+04	32	1.82e+05	262.51
chloroethane	4.75e+02	22	5.52e+02	116.24	bis(2-Chloroethyl)ether	2.73e+04	33	5.29e+04	193.61
ethylene Chloride	2.22e+04	37	4.88e+04	220.11	1,4-Dichlorobenzene	1.84e+03	25	3.05e+03	165.85
acetone	8.48e+05	44	5.12e+06	603.52	Benzyl alcohol	6.91e+03	31	9.93e+03	143.72
1,1-Dichloroethene	1.84e+04	42	6.15e+04	334.54	1,2-Dichlorobenzene	1.50e+04	33	2.46e+04	164.27
1,1-Dichloroethane	2.88e+04	43	8.38e+04	290.89	2-Methylphenol	1.49e+04	33	2.10e+04	140.51
total 1,2-Dichloroethene	5.18e+03	38	8.09e+03	156.33	4-Methylphenol	3.12e+04	33	4.61e+04	148.07
chloroform	1.62e+05	44	5.59e+05	344.07	Isophorone	3.79e+05	33	8.89e+05	234.92
1,2-Dichloroethane	2.55e+04	43	7.91e+04	309.69	2,4-Dimethylphenol	2.41e+04	33	4.11e+04	171.05
2-Butanone	3.00e+06	44	1.52e+07	506.90	Benzoic acid	1.05e+06	33	5.56e+06	527.29
1,1,1-Trichloroethane	3.74e+06	44	2.26e+07	603.44	2,4-Dichlorophenol	1.75e+02	13	5.09e+01	29.13
1,2-Dichloropropane	6.60e+03	39	1.35e+04	204.40	1,2,4-Trichlorobenzene	6.30e+03	29	1.48e+04	234.93
1,1,2-Trichloroethene	6.95e+05	44	3.05e+06	439.21	Naphthalene	2.58e+05	33	5.46e+05	211.81
1,1,2-Trichloroethane	2.52e+04	43	7.44e+04	295.69	Hexachlorobutadiene	1.49e+04	33	2.86e+04	191.38
1,1,1,2-Tetrachloroethane	8.13e+04	44	2.44e+05	300.31	2-Methylnaphthalene	1.31e+05	33	2.45e+05	186.66
1,1,1,2,2-Pentachloroethane	1.68e+06	44	9.20e+06	546.76	Dimethylphthalate	5.11e+04	33	1.35e+05	263.65
1,1,1,2,2,2-Hexachloroethane	8.31e+03	34	1.33e+04	160.57	Acenaphthylene	1.11e+03	21	2.45e+03	221.78
1,1,1,2,2,2-Tetrachloroethane	5.62e+00	11	7.41e+06	431.22	2,6-Dinitrotoluene	5.19e+02	19	7.80e+02	150.07
1,1,1,2,2,2-Tetrachloroethane	3.96e+06	44	1.96e+07	494.10	Acenaphthene	4.71e+03	30	6.03e+03	127.92
1,1,1,2,2,2-Tetrachloroethane	5.24e+04	41	1.74e+05	332.93	4-Nitrophenol	2.11e+03	19	2.40e+03	113.72
1,1,1,2,2,2-Tetrachloroethane	8.79e+05	44	3.53e+06	401.75	Dibenzofuran	1.65e+03	24	2.82e+03	171.30
1,1,1,2,2,2-Tetrachloroethane	2.79e+04	43	7.06e+04	252.64	Diethylphthalate	2.13e+04	33	5.06e+04	237.23
1,1,1,2,2,2-Tetrachloroethane	3.65e+06	44	1.52e+07	415.90	Fluorene	6.51e+03	31	8.78e+03	134.90
					N-Nitrosodiphenylamine	9.33e+03	33	1.42e+04	151.88
					Hexachlorobenzene	1.23e+03	21	2.74e+03	223.08
					Pentachlorophenol	3.16e+04	31	4.82e+04	152.57
					Phenanthrene	9.41e+03	33	1.37e+04	145.82
					Anthracene	4.57e+02	19	4.05e+02	88.55
					Di-n-butylphthalate	2.99e+05	33	8.14e+05	272.54
					Fluoranthene	4.01e+03	30	5.50e+03	137.39
					Pyrene	4.85e+03	30	6.24e+03	128.85
					Butylbenzylphthalate	1.64e+05	33	3.50e+05	213.57
					Benzo(a)anthracene	4.00e+03	28	5.54e+03	138.49
					Chrysene	4.22e+03	29	5.92e+03	140.33
					bis(2-Ethylhexyl)phthalate	1.29e+06	33	3.24e+06	249.92
					Di-n-octylphthalate	1.34e+04	33	2.73e+04	204.18
					Benzo(b)fluoranthene	3.76e+03	26	5.29e+03	140.83
					Benzo(k)fluoranthene	3.76e+03	26	5.29e+03	140.83
					Benzo(a)pyrene	1.26e+03	21	2.50e+03	198.76
					Indeno(1,2,3-cd)pyrene	5.28e+02	19	4.97e+02	94.14
					Dibenz(a,h)anthracene	1.66e+02	5	5.37e+01	32.33
					Benzo(g,h,i)perylene	4.34e+02	19	3.93e+02	90.40
					Alpha-BHC	6.60e+01	35	8.43e+01	127.75
					Beta-BHC	1.42e+02	40	2.20e+02	154.19
					Aldrin	3.44e+02	42	1.21e+03	350.02
					Heptachlor Epoxide	5.48e+00	13	2.27e+00	41.40
					4,4-DDE	1.58e+02	36	2.25e+02	141.97
					4,4-DDD	3.77e+02	41	7.22e+02	191.38
					4,4-DDT	2.64e+02	40	4.31e+02	163.11
					AROCLOR-1242	6.54e+03	42	2.93e+04	447.00
					AROCLOR-1248	3.39e+03	42	7.11e+03	209.45
					AROCLOR-1254	2.66e+04	42	1.00e+05	376.54
					AROCLOR-1260	2.76e+04	42	9.34e+04	337.99

  

PARAMETER (MG/KG)	ARITHMETIC MEAN	n	STD	C-O-V
antimony	2.92e+01	8	5.39e+01	184.58
barium	4.04e+02	19	1.46e+03	360.48
cadmium	1.02e+02	18	3.99e+02	390.39
calcium	1.74e+04	19	1.96e+04	112.52
chromium, total	2.40e+02	19	8.52e+02	354.78
cobalt	1.25e+01	19	1.52e+01	121.40
copper	3.93e+02	19	1.32e+03	334.67
lead	1.07e+03	19	3.92e+03	367.02
manganese	1.37e+02	19	1.17e+02	85.74
mercury	2.24e+00	19	8.19e+00	365.97
mickel	1.76e+01	19	2.09e+01	118.58
potassium	1.08e+03	19	1.87e+03	172.49
selenium	9.02e+00	19	3.59e+01	397.51
silver	1.77e+01	19	7.13e+01	403.54
zinc	4.58e+02	19	1.07e+03	232.52
cyanide, total	4.24e+00	19	7.11e+00	167.60

TABLE U-19

## S STILL BOTTOMS AND TREATMENT LAGOON

PARAMETER (UG/KG)	ARITHMETIC MEAN	n	STD	C-O-V	PARAMETER (UG/KG)	ARITHMETIC MEAN	n	STD	C-O-V
Ethylene Chloride	4.99e+04	28	9.64e+04	193.40	Phenol	1.67e+04	29	3.71e+04	222.67
Acetone	3.45e+03	13	3.85e+03	111.51	bis(2-Chloroethyl)ether	1.40e+04	29	2.52e+04	179.12
1,1-Dichloroethane	3.71e+03	22	6.17e+03	166.41	2-Chlorophenol	1.30e+02	1		
total 1,2-Dichloroethene	3.94e+04	29	8.17e+04	207.11	1,3-Dichlorobenzene	2.99e+02	15	1.95e+02	65.07
Chloroform	1.95e+05	29	5.22e+05	267.60	1,4-Dichlorobenzene	1.02e+03	19	1.40e+03	136.46
2-Dichloroethane	1.02e+04	26	1.43e+04	140.69	Benzyl alcohol	4.56e+02	17	4.75e+02	104.14
Butanone	8.07e+04	29	1.31e+05	162.66	1,2-Dichlorobenzene	1.05e+04	29	1.67e+04	159.65
1,1,1-Trichloroethane	8.00e+05	29	3.89e+06	486.25	2-Methylphenol	4.53e+03	27	5.71e+03	126.07
Carbon Tetrachloride	1.57e+05	29	6.70e+05	426.21	4-Methylphenol	7.04e+03	28	9.89e+03	140.44
2-Dichloropropane	3.58e+03	21	6.22e+03	173.60	Isophorone	2.28e+05	29	5.43e+05	237.90
1,1,2-Trichloroethane	1.27e+05	29	3.23e+05	253.69	2,4-Dimethylphenol	6.56e+02	17	7.13e+02	108.55
1,1,2-Trichloroethane	1.81e+03	19	2.53e+03	139.78	Benzoic acid	6.99e+03	17	1.27e+04	181.84
Benzene	3.23e+04	29	4.98e+04	154.50	2,4-Dichlorophenol	7.88e+02	19	1.15e+03	145.69
Methyl-2-Pentanone	1.63e+05	29	3.44e+05	210.96	1,2,4-Trichlorobenzene	7.88e+02	19	1.08e+03	137.30
1,2-Dichloroethane	2.39e+05	29	3.66e+05	153.18	Naphthalene	9.04e+04	29	1.53e+05	169.49
Toluene	1.59e+06	29	4.31e+06	271.78	Hexachlorobutadiene	7.66e+03	29	9.64e+03	125.77
Chlorobenzene	2.00e+00	1			4-Chloro-3-methylphenol	2.54e+02	14	9.35e+01	36.78
1,2-Dichlorobenzene	7.25e+05	29	1.63e+06	224.73	2-Methylnaphthalene	5.37e+04	29	8.74e+04	162.72
Styrene	2.40e+04	29	4.32e+04	180.09	2,4,6-Trichlorophenol	2.78e+02	14	1.58e+02	56.84
total Xylenes	1.91e+06	29	2.75e+06	143.85	2,4,5-Trichlorophenol	9.60e+01	1		
					2-Chloronaphthalene	3.92e+02	16	4.27e+02	108.95
gamma-BHC (Lindane)	1.69e+02	19	2.79e+02	164.96	Dimethylphthalate	3.83e+04	29	8.38e+04	219.15
Endosulfan I	1.74e+02	19	2.98e+02	170.79	Acenaphthylene	1.31e+03	19	2.60e+03	198.94
4-DDT	2.47e+03	21	6.46e+03	261.60	Acenaphthene	9.74e+02	20	1.36e+03	139.12
Endrin Ketone	9.73e+01	14	9.25e+01	95.04	4-Nitrophenol	1.28e+03	15	4.77e+02	37.22
OCCLOR-1248	1.10e+04	21	2.36e+04	213.62	Dibenzofuran	2.78e+02	15	1.37e+02	49.23
OCCLOR-1254	7.40e+03	20	1.30e+04	175.79	Diethylphthalate	1.18e+04	29	2.10e+04	177.33
OCCLOR-1260	6.42e+03	20	1.11e+04	173.32	Fluorene	1.63e+03	21	2.57e+03	157.55
					N-Nitrosodiphenylamine	4.45e+03	27	5.58e+03	125.50
					4-Bromophenyl-phenylether	5.56e+02	17	6.45e+02	115.93
					Hexachlorobenzene	5.07e+02	18	6.48e+02	127.86
					Pentachlorophenol	2.09e+04	29	2.56e+04	122.34
					Phenanthrene	2.30e+03	25	3.00e+03	130.06
					Anthracene	5.58e+02	17	8.38e+02	150.28
					Di-n-butylphthalate	8.46e+04	29	1.47e+05	173.20
					Fluoranthene	3.96e+02	17	4.11e+02	103.81
					Pyrene	8.43e+02	19	1.30e+03	153.70
					Butylbenzylphthalate	9.96e+04	29	2.02e+05	202.69
					Benzo(a)anthracene	2.67e+02	15	1.06e+02	39.58
					Chrysene	2.53e+02	15	9.10e+01	35.92
					bis(2-Ethylhexyl)phthalate	3.62e+05	29	6.25e+05	172.73
					Di-n-octylphthalate	4.01e+03	27	6.20e+03	154.69
					Benzo(b)fluoranthene	2.70e+02	16	9.96e+01	36.89
					Benzo(k)fluoranthene	2.70e+02	16	9.96e+01	36.89
					Benzo(a)pyrene	2.04e+02	11	2.06e+01	10.13

  

PARAMETER (MG/KG)	ARITHMETIC MEAN	n	STD	C-O-V
Antimony	8.03e+00	8	1.60e+01	198.88
Strontium	2.08e+02	12	4.40e+02	211.26
Cadmium	1.35e+01	12	3.31e+01	245.32
Calcium	1.11e+04	12	1.55e+04	138.83
Ironium, total	1.80e+02	12	3.98e+02	221.01
Cobalt	1.53e+01	12	1.81e+01	118.25
Copper	6.71e+01	12	9.82e+01	146.28
Zinc	7.73e+02	12	1.78e+03	230.28
Magnesium	3.50e+03	12	3.34e+03	95.48
Mercury	1.69e+00	12	3.06e+00	181.53
Nickel	1.14e+01	12	3.64e+00	31.81
Selenium	8.03e-01	12	6.98e-01	87.03
Lead	3.32e+02	12	6.28e+02	189.54
Cyanide, total	7.82e+00	12	1.99e+01	253.95

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TABLE U-19

## S SEDIMENTS

PARAMETER (UG/KG)	ARITHMETIC MEAN	n	STD	C-O-V	PARAMETER (MG/KG)	ARITHMETIC MEAN	n	STD	C-O-V
1,1-Dichloroethane	1.00e+01	17	3.84e+00	3.83e+01	Barium	5.57e+01	18	2.53e+01	4.55e+01
Ethylene Chloride	1.82e+01	16	1.12e+01	6.14e+01	Calcium	1.56e+04	18	2.25e+04	1.44e+02
Total 1,2-Dichloroethene	4.87e+00	18	1.94e+00	3.98e+01	Chromium, Total	3.07e+01	18	6.12e+01	1.99e+02
Chloroform	4.57e+00	18	2.43e+00	5.33e+01	Copper	4.04e+01	18	8.06e+01	1.99e+02
Butanone	8.27e+00	15	1.27e+00	1.54e+01	Magnesium	5.26e+03	18	7.71e+03	1.46e+02
1,1-Trichloroethane	3.00e+00	1			Mercury	6.13e-01	18	2.05e+00	3.35e+02
Benzene	7.83e+02	18	3.30e+03	4.21e+02	Nickel	1.39e+01	18	1.03e+01	7.43e+01
Toluene	2.38e+01	18	4.53e+01	1.90e+02	Selenium	4.50e-01	18	2.90e-01	6.45e+01
Methylbenzene	1.18e+01	18	2.96e+01	2.51e+02	Vanadium	2.05e+01	18	1.38e+01	6.74e+01
Total Xylenes	1.57e+01	18	4.60e+01	2.93e+02					
Phenol	1.24e+02	2	9.33e+01	7.53e+01					
Bis(2-Chloroethyl)ether	3.15e+02	17	9.98e+01	3.17e+01					
Bis(2-Chloroisopropyl)ether	4.46e+02	18	4.32e+02	9.69e+01					
Methylphenol	2.32e+02	11	4.79e+01	2.07e+01					
4-Dimethylphenol	3.15e+02	17	1.06e+02	3.35e+01					
Benzoic acid	8.00e+02	12	4.04e+02	5.05e+01					
Phthalene	2.61e+02	17	1.06e+02	4.07e+01					
Methylnaphthalene	2.50e+02	15	9.90e+01	3.97e+01					
Benzenofuran	2.26e+02	5	5.48e+00	2.42e+00					
Buorene	3.10e+02	18	1.41e+02	4.55e+01					
1,2-Dichlorobenzene	1.40e+02	1							
2,4-Dichlorophenol	1.39e+02	2	1.29e+02	9.34e+01					
1-Methylnaphthalene	2.75e+02	18	1.43e+02	5.18e+01					
Anthracene	9.15e+01	2	1.20e+01	1.31e+01					
Di-n-butylphthalate	1.11e+02	4	4.71e+01	4.26e+01					
1-Methylnaphthalene	3.46e+02	18	2.44e+02	7.05e+01					
Pyrene	3.33e+02	18	2.40e+02	7.21e+01					
Methylbenzylphthalate	1.65e+02	2	7.07e+00	4.29e+00					
1-Methylanthracene	3.03e+02	14	1.75e+02	5.77e+01					
Fluorene	3.05e+02	18	1.88e+02	6.16e+01					
Bis(2-Ethylhexyl)phthalate	1.57e+03	17	3.16e+03	2.01e+02					
1-Fluoranthene	3.52e+02	18	3.46e+02	9.81e+01					
2-Fluoranthene	3.58e+02	18	3.49e+02	9.74e+01					
1-Pyrene	3.02e+02	18	1.55e+02	5.13e+01					
1,2,3-CDPYRENE	2.86e+02	17	7.50e+01	2.62e+01					
1,8-DIANTHRACENE	1.45e+02	3	6.38e+01	4.40e+01					
1,2,6,9-TETRAPERYLENE	3.12e+02	18	1.01e+02	3.24e+01					
1,2-DICHLOROETHANE	1.68e+01	18	1.75e+01	1.04e+02					
1,2-DICHLOROETHANE	3.78e+02	18	1.06e+03	2.81e+02					
1,2-DICHLOROETHANE	1.53e+03	18	4.05e+03	2.65e+02					
1,2-DICHLOROETHANE	1.72e+02	13	6.39e+01	3.71e+01					

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TABLE U-19

## S SURFACE WATERS

PARAMETER (UG/L)	ARITHMETIC MEAN	n	STD	C-O-V
Chloroethane	1.18e+01	5	1.09e+01	92.33
Acetone	8.00e+01	5	1.68e+02	209.63
1,1-Dichloroethane	1.50e+00	2	7.07e-01	47.14
Total 1,2-Dichloroethene	2.30e+00	5	7.58e-01	32.97
Butanone	3.76e+01	5	5.85e+01	155.62
Benzene	9.40e+01	5	2.05e+02	217.66
Methyl-2-Pentanone	1.38e+01	5	1.97e+01	142.59
Toluene	4.50e+00	5	2.76e+00	61.36
Methylbenzene	3.20e+00	5	1.57e+00	48.91
Total Xylenes	9.00e+00	5	1.45e+01	161.49
Phenol	1.66e+01	5	1.77e+01	106.54
1,2-Dichloroethyl ether	1.94e+01	5	3.22e+01	165.98
Methylphenol	5.00e+00	5	0.00e+00	0.00
1,2-Dichloroisopropyl ether	9.80e+00	5	1.07e+01	109.52
Methylphenol	1.23e+02	5	2.61e+02	212.69
Phosphorone	5.00e+00	5	0.00e+00	0.00
4-Dimethylphenol	6.40e+00	5	3.13e+00	48.91
Benzoic acid	3.70e+01	5	2.68e+01	72.52
2-Chloro-3-methylphenol	2.00e+00	1		
COCLOR-1248	4.18e-01	5	2.60e-01	62.10
Aluminum	4.78e+02	5	3.87e+02	80.87
Asenic	1.01e+01	5	1.95e+01	194.24
Barium	1.46e+02	5	1.03e+02	70.45
Beryllium	1.36e-01	5	8.05e-02	59.19
Bismuth	2.78e-01	5	2.73e-01	98.33
Cadmium	1.14e+05	5	1.32e+05	116.39
Cromium, Total	1.01e+01	5	1.04e+01	102.73
Copper	1.24e+01	5	5.37e+00	43.28
Cobalt	4.97e+03	5	5.64e+03	113.46
Cobalt	1.10e+01	5	8.66e+00	78.61
Cesium	2.29e+04	5	2.54e+04	110.89
Manganese	7.72e+02	5	7.61e+02	98.62
Nickel	3.90e+01	5	2.75e+01	70.45
Rubidium	1.10e+04	5	1.23e+04	111.85
Selenium	1.22e+00	5	4.92e-01	40.32
Sodium	3.58e+04	5	4.05e+04	113.12
Zinc	5.62e+01	5	2.25e+01	40.01

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**Appendix V**

**Modeling Of Volatile Organic Emissions  
To Determine Exposure Point Concentrations**

## Appendix V

### MODELING OF VOLATILE ORGANIC EMISSIONS TO DETERMINE EXPOSURE POINT CONCENTRATIONS

Volatilization of contaminants at uncontrolled hazardous waste sites may contribute to overall air loading at the Site. A predictive model is used to estimate the rate of these emissions over time. Farmer's equation as modified by Shen and Farino, described in the Superfund Exposure Assessment Manual (EPA, 1988), assumes that diffusion into the atmosphere occurs at a plane surface where concentrations remain constant, and ignores biodegradation, transport in water, and adsorption.

$$E_i = \frac{D_i C_{si} A (Pt^{4/3}) M_i}{d_{sc}}$$

where

- $E_i$  = emission rate of component i (g/sec)
- $D_i$  = diffusion coefficient of chemical i in air (cm<sup>2</sup>/sec)
- $C_{si}$  = saturation vapor concentration of chemical i (g/cm<sup>3</sup>)
- $A$  = exposed area (cm<sup>2</sup>)
- $Pt$  = total soil porosity (unitless)
- $M_i$  = mole fraction of chemical i in the waste (gmole/gmole)
- $d_{sc}$  = effective depth of soil cover (cm)

$D_i$ , the diffusion coefficient, is provided in the above reference for most chemicals, or else is calculated using Fuller's method, also described in the reference.

$C_{si}$ , the saturation vapor concentration, is calculated as follows:

$$C_{si} = \frac{VP_i MW_i}{RT}$$

where

- $VP$  = vapor pressure of chemical i (mm Hg)
- $MW$  = mole weight of chemical i (g/mole)
- $R$  = molar gas constant (63,361 mm Hg-cm<sup>3</sup>/mole-K)
- $T$  = absolute temperature (K)

T, the temperature, is taken to be 19 centigrade (292 K), which is the mean temperature for the period of May 1 to October 31 as presented in the Soil Survey for Lake County Indiana (July, 1972).

A, the exposed area, is estimated based on review of the analytical data and Site maps. Area perimeters are delineated as follows:

On Site - Based on analytical results, the entire area covered by the geophysical survey is included.

Still Bottoms/Treatment Lagoon - A roughly rectangular area is included, beginning at the edge of the firepond to approximately 40 ft west of SB70, and from SB21 to AP-44.

Off Site - The exposed area follows the contour lines at the north end of the Off Site area, south along the western edge to AP-66, east to AP-9, and back north along AP-20 to AP-19.

Kapica-Pazmey - Starting at SB53, the area runs south to the boundary of the geophysical survey and follows it around the southern boundary of Kapica-Pazmey. It then heads northeast to SB44, where it turns west and runs back to SB53.

The area within these perimeters is then calculated in the prescribed units.

Pt, total porosity, is assumed to be 0.40, a reasonable value given the loamy fine sands present at the Site as described in the Lake County Soil Survey.

M<sub>i</sub>, the mole fraction of the chemical in the buried waste, is estimated, since the molecular weight of the soil portion of the waste/soil mix is not known. Instead, the ratio of the mole fraction of each chemical to the sum of the mole fractions for all chemicals of potential concern is calculated as follows:

$$M_i = \frac{\text{Mf for chemical } i}{\text{sum of Mf for all chemicals of Potential Concern}}$$

where

$$M_f = \frac{C_i}{MW_i}$$

where

$$\begin{aligned} C_i &= \text{concentration of chemical } i \text{ (mg/kg)} \\ MW_i &= \text{molecular weight of chemical } i \text{ (g/mole)} \end{aligned}$$

Dsc, the effective depth of soil cover is considered to be the depth to the water table. Since the controlling factor for the model is diffusion of chemical vapor through the soil cover, a vapor path through the soil is required. This vapor path does not exist below the water table, although sample points at lower depths indicate the contamination does extend lower.

Tables 1 through 5 of this appendix contain the values for each of the expressions within the equation, and the calculated Baseline Emission Estimates for each Site Area.

### DISPERSION

Estimates of downwind component concentrations were calculated using the following equation from the Superfund Exposure Assessment Manual:

$$C(x) = \frac{Q}{\pi O_y O_z u} * D$$

where

- C(x) = concentration of chemical i at distance x (g/m<sup>3</sup>)
- Q = emission rate of chemical i (same as E<sub>i</sub>) (g/sec)
- O<sub>y</sub> = dispersion coefficient, lateral direction (meters)
- O<sub>z</sub> = dispersion coefficient, vertical direction (meters)
- u = mean wind speed (m/sec)
- π = 3.14
- D = fraction of time wind blows towards receptor (unitless)

Dispersion coefficient values are derived from tables in the Superfund Exposure Assessment Manual. To calculate long-term atmospheric concentrations equated with annual average exposure conditions, a wind speed of 3 m/sec and stability class D were assumed for the Site to obtain conservative exposure point estimates. The wind is assumed to blow in the direction of the receptor for 30 % of the time.

The model allows prediction of concentrations at a distance no closer than 100 meters from the point of release. Downwind estimates to calculate exposures off-Site were calculated using a distance of 500 meters.

Since the wind blows in only one direction at a time, the combined concentration from the five areas at a given receptor point would be the sum of differing fractions of the concentration of each area. Due to the difficulty of determining this combined exposure, the maximum concentration from the five areas is carried forward to the quantitative risk assessment for both onsite (100 meters) and offsite (500 meters) scenerios. A summary of the concentrations onsite and offsite and the maximum value for each compound is presented in table 6 of this appendix.

The values used for exposed area and effective depth of soil cover are presented in the following table:

<u>SITE AREA</u>	<u>Exposed Area</u>	<u>Depth of soil cover</u>
On Site	1.1x10 <sup>8</sup> cm <sup>2</sup>	152 cm
Still Bottoms/ Treatment Lagoon	6.4x10 <sup>7</sup> cm <sup>2</sup>	183 cm
Off Site	1.6x10 <sup>8</sup> cm <sup>2</sup>	335 cm
Kapica Pazmey - surface soils	4.7x10 <sup>7</sup> cm <sup>2</sup>	53 cm
Kapica Pazmey - Subsurface soils	4.7x10 <sup>7</sup> cm <sup>2</sup>	427 cm

Table V-1

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Onsite Containment Area

COMPOUND	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (Cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	Estimated Downwind Concentration	
										100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
----- Chemical Emission (Ei) Calculation Variables -----											
Chloroethane	51	3.80e+03	1.06e-02	62.4	0.10767	1.60e+04	3.14e+02	2.01e-01	4.92e+01	4.17e-02	2.36e-03
Acetone	58	2.70e+02	8.60e-04	66.86	0.10245	3.51e+00	6.06e-02	3.89e-05	7.30e-04	6.19e-07	3.50e-08
1,1-Dichloroethane	99	1.82e+02	9.89e-04	79.92	0.08853	1.19e-02	1.20e-04	7.71e-08	1.44e-06	1.22e-09	6.89e-11
Total-1,2-Dichloroethene	97	2.08e+02	1.11e-03	75.96	0.09059	5.20e+00	5.36e-02	3.44e-05	7.37e-04	6.24e-07	3.53e-08
Chloroform	119	1.51e+02	9.86e-04	76.98	0.08818	1.48e+00	1.24e-02	7.98e-06	1.48e-04	1.25e-07	7.09e-09
1,2-Dichloroethane	99	6.40e+01	3.48e-04	79.92	0.08853	9.70e-01	9.80e-03	6.29e-06	4.13e-05	3.50e-08	1.98e-09
2-Butanone	72	7.75e+01	3.06e-04	87.32	0.08890	2.01e-01	2.79e-03	1.79e-06	1.04e-05	8.80e-09	4.97e-10
1,1,1-Trichloroethane	133	1.23e+02	8.98e-04	97.44	0.07917	1.31e+03	9.85e+00	6.33e-03	9.59e-02	8.13e-05	4.59e-06
1,2-Dichloropropane	113	4.20e+01	2.61e-04	100.38	0.07942	7.51e-01	6.65e-03	4.27e-06	1.88e-05	1.59e-08	9.02e-10
Trichloroethene	131	5.79e+01	4.16e-04	93.48	0.08067	1.22e+01	9.30e-02	5.97e-05	4.28e-04	3.62e-07	2.05e-08
1,1,2-Trichloroethane	133	3.00e+01	2.19e-04	97.44	0.07917	3.67e-02	2.76e-04	1.77e-07	6.56e-07	5.56e-10	3.14e-11
Benzene	78	9.52e+01	4.08e-04	110.88	0.07954	3.61e+02	4.63e+00	2.98e-03	2.06e-02	1.74e-05	9.85e-07
4-Methyl-2-Pentanone	100	6.00e+00	3.29e-05	128.24	0.07247	5.23e-01	5.23e-03	3.36e-06	1.71e-06	1.45e-09	8.19e-11
Tetrachloroethene	166	1.78e+01	1.62e-04	111	0.07360	5.90e+03	3.55e+01	2.28e-02	5.81e-02	4.92e-05	2.78e-06
1,1,2,2-Tetrachloroethane	168	5.00e+00	4.61e-05	114.96	0.07244	3.90e+00	2.32e-02	1.49e-05	1.06e-05	8.99e-09	5.08e-10
Toluene	92	2.81e+01	1.42e-04	131.34	0.07242	7.93e+04	8.62e+02	5.53e-01	1.21e+00	1.03e-03	5.81e-05
Chlorobenzene	113	1.17e+01	7.26e-05	128.4	0.07149	4.40e-02	3.89e-04	2.50e-07	2.76e-07	2.34e-10	1.32e-11
Ethylbenzene	106	7.00e+00	4.07e-05	151.8	0.06689	6.70e+03	6.32e+01	4.06e-02	2.36e-02	2.00e-05	1.13e-06
Styrene	104	5.00e+00	2.85e-05	147.84	0.06781	6.20e+00	5.96e-02	3.83e-05	1.58e-05	1.34e-08	7.57e-10
Total Xylenes	106	1.00e+01	5.82e-05	151.8	0.06689	2.50e+04	2.36e+02	1.51e-01	1.26e-01	1.06e-04	6.02e-06
Phenol	94	3.41e-01	1.76e-06	116.36	0.07610	4.32e-01	4.59e-03	2.95e-06	8.42e-08	7.13e-11	4.03e-12
1,3-Dichlorobenzene	147	2.28e+00	1.84e-05	145.92	0.06600	2.30e-01	1.57e-03	1.01e-06	2.60e-07	2.20e-10	1.25e-11
1,4-Dichlorobenzene	147	1.18e+00	9.52e-06	145.92	0.06600	5.63e-01	3.83e-03	2.46e-06	3.30e-07	2.79e-10	1.58e-11
1,2-Dichlorobenzene	147	1.00e+00	8.07e-06	145.92	0.06600	9.90e+00	6.73e-02	4.32e-05	4.91e-06	4.16e-09	2.35e-10
2-Methylphenol	108	2.40e-01	1.42e-06	136.82	0.06987	1.58e+00	1.47e-02	9.42e-06	2.00e-07	1.69e-10	9.57e-12
4-Methylphenol	108	1.10e-01	6.52e-07	136.82	0.06987	2.51e+00	2.32e-02	1.49e-05	1.45e-07	1.23e-10	6.93e-12
2,4-Dimethylphenol	122	5.90e-02	3.95e-07	157.28	0.06492	2.39e+00	1.96e-02	1.26e-05	6.87e-08	5.82e-11	3.29e-12
Benzoic acid	122	9.52e+01	6.37e-04	138.34	0.06869	4.90e-02	4.02e-04	2.58e-07	2.41e-06	2.04e-09	1.15e-10
2,4-Dichlorophenol	163	5.90e-02	5.28e-07	151.4	0.06442	2.25e-01	1.38e-03	8.87e-07	6.43e-09	5.45e-12	3.08e-13
Naphthalene	128	2.60e-04	1.83e-09	180.84	0.06072	9.00e+01	7.03e-01	4.51e-04	1.07e-08	9.05e-12	5.11e-13
2-Methylnaphthalene	142	5.90e-02	4.60e-07	201.3	0.05732	5.50e+01	3.87e-01	2.49e-04	1.40e-06	1.18e-09	6.70e-11
2,4,5-Trichlorophenol	197	1.00e+00	1.08e-05	168.92	0.06056	2.13e-01	1.08e-03	6.95e-07	9.71e-08	8.23e-11	4.65e-12
Dimethylphthalate	194	1.00e-02	1.06e-07	206.72	0.05533	3.50e+00	1.80e-02	1.16e-05	1.46e-08	1.23e-11	6.97e-13
Acenaphthylene	152	2.90e-02	2.42e-07	213.84	0.05545	8.98e-01	5.91e-03	3.79e-06	1.09e-08	9.19e-12	5.20e-13
Acenaphthene	154	1.55e-03	1.31e-08	217.8	0.05492	2.06e+00	1.34e-02	8.59e-06	1.32e-09	1.12e-12	6.31e-14
Diethylphthalate	222	3.50e-03	4.26e-08	247.64	0.05049	4.70e-02	2.12e-04	1.36e-07	6.24e-11	5.29e-14	2.99e-15
Fluorene	116	7.10e-04	4.52e-09	234.3	0.05446	2.32e+00	2.00e-02	1.28e-05	6.75e-10	5.71e-13	3.23e-14
Pentachlorophenol	266	1.10e-04	1.61e-09	203.96	0.05469	1.60e-01	6.02e-04	3.86e-07	7.23e-12	6.13e-15	3.46e-16
Phenanthrene	178	6.80e-04	6.64e-09	250.8	0.05091	4.26e+00	2.40e-02	1.54e-05	1.11e-09	9.40e-13	5.31e-14

Table V-1

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Onsite Containment Area

COMPOUND	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (Cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	Estimated Downwind Concentration	
										100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
Anthracene	178	1.95e-04	1.91e-09	250.8	0.05091	9.40e-02	5.28e-04	3.39e-07	7.01e-12	5.94e-15	3.36e-16
Di-n-butylphthalate	278	1.00e-05	1.53e-10	329.48	0.04362	1.16e+01	4.18e-02	2.68e-05	3.81e-11	3.23e-14	1.82e-15
Fluoranthene	202	5.00e-06	5.54e-11	283.8	0.04764	7.93e-01	3.93e-03	2.52e-06	1.42e-12	1.20e-15	6.80e-17
Pyrene	202	2.50e-06	2.77e-11	283.8	0.04764	9.34e-01	4.63e-03	2.97e-06	8.36e-13	7.08e-16	4.01e-17
Butylbenzylphthalate	312	8.60e+06	1.47e+02	375.02	0.04077	2.27e+00	7.29e-03	4.68e-06	5.99e+00	5.07e-03	2.87e-04
Benzo(a)anthracene	228	2.20e-08	2.75e-13	320.76	0.04463	1.70e-01	7.46e-04	4.79e-07	1.25e-15	1.06e-18	6.01e-20
Chrysene	228	6.30e-09	7.88e-14	320.76	0.04463	8.40e-02	3.68e-04	2.37e-07	1.78e-16	1.50e-19	8.50e-21
bis(2-Ethylhexyl)phthalat	391	8.60e+06	1.85e+02	493.16	0.03535	1.40e+02	3.58e-01	2.30e-04	3.20e+02	2.71e-01	1.53e-02
Endosulfan 1	407	5.50e-06	1.23e-10	310.82	0.04417	5.95e-03	1.46e-05	9.39e-09	1.09e-14	9.21e-18	5.21e-19
4,4-DDT	355	5.50e-06	1.07e-10	346.32	0.04215	1.59e-02	4.48e-05	2.88e-08	2.77e-14	2.35e-17	1.33e-18
TOTAL PCBs	328	7.70e-05	1.39e-09	235.32	0.05074	8.08e+00	2.46e-02	1.58e-05	2.37e-10	2.01e-13	1.14e-14
Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	2.00e+01	1.67e-01	1.07e-04	3.00e-05	2.54e-08	1.44e-09
Ethyl Methyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	1.10e+02	9.17e-01	5.89e-04	1.65e-04	1.40e-07	7.91e-09
Diethyl Benzenes	106	7.00e+00	4.07e-05	151.8	0.06689	2.80e+01	2.64e-01	1.70e-04	9.85e-05	8.35e-08	4.72e-09
Methyl Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	1.40e+00	1.17e-02	7.49e-06	2.10e-06	1.78e-09	1.01e-10
Methyl Ethenyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	1.40e+00	1.17e-02	7.49e-06	2.10e-06	1.78e-09	1.01e-10
Trimethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	3.90e+02	3.25e+00	2.09e-03	1.83e-02	1.55e-05	8.77e-07
Dimethyl ethyl benzenes	106	7.00e+00	4.07e-05	151.8	0.06689	2.00e+02	1.89e+00	1.21e-03	7.04e-04	5.96e-07	3.37e-08
Tetramethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	1.10e-02	9.17e-05	5.89e-08	5.16e-07	4.37e-10	2.47e-11
Oxygenated Benzenes	106	1.00e+02	5.82e-04	132.86	0.07091	2.60e+02	2.45e+00	1.57e-03	1.39e-02	1.17e-05	6.64e-07
Cyclic alkanes	98	1.44e+02	7.75e-04	131.34	0.07189	5.30e+01	5.41e-01	3.47e-04	4.12e-03	3.49e-06	1.97e-07
Cyclic Alkenes	98	1.44e+02	7.75e-04	131.34	0.07189	3.70e+02	3.78e+00	2.42e-03	2.88e-02	2.44e-05	1.38e-06
Halogenated Alkanes	133	1.23e+02	8.98e-04	97.44	0.07917	2.20e+00	1.65e-02	1.06e-05	1.61e-04	1.36e-07	7.71e-09
n-chain Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	3.20e+02	3.72e+00	2.39e-03	2.27e-02	1.92e-05	1.09e-06
Branched Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	1.80e+02	2.09e+00	1.34e-03	1.28e-02	1.08e-05	6.11e-07
Branched Alkenes/Alkynes	86	1.20e+02	5.66e-04	110.88	0.07853	6.10e+02	7.09e+00	4.55e-03	4.32e-02	3.66e-05	2.07e-06
Methylated Naphthalenes	108	2.40e-01	1.83e-09	180.84	0.06072	8.40e+00	7.78e-02	4.99e-05	1.18e-09	1.00e-12	5.66e-14
Methylated Phenols	108	2.40e-01	1.42e-06	136.82	0.06987	1.10e+00	1.02e-02	6.54e-06	1.39e-07	1.17e-10	6.64e-12
Cyclic Ketones	138	3.80e-01	2.88e-06	177.74	0.06078	6.20e-01	4.49e-03	2.88e-06	1.08e-07	9.12e-11	5.16e-12
Simple Alcohols	74	4.40e+00	1.79e-05	91.28	0.08694	2.30e-03	3.11e-05	2.00e-08	6.61e-09	5.60e-12	3.17e-13
Non-Cyclic Acids	72	3.20e+00	1.26e-05	68.38	0.09820	2.20e+02	3.06e+00	1.96e-03	5.20e-04	4.40e-07	2.49e-08
Amines	113	1.00e-03	6.20e-09	131.95	0.07065	1.70e+02	1.50e+00	9.66e-04	9.03e-08	7.65e-11	4.32e-12
PCBs	328	7.70e-05	1.39e-09	235.32	0.05074	7.50e+00	2.29e-02	1.47e-05	2.20e-10	1.87e-13	1.05e-14
Furans	72	1.31e+02	5.18e-04	87.32	0.08890	1.40e+00	1.94e-02	1.25e-05	1.23e-04	1.04e-07	5.87e-09

Table V-1

VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Onsite Containment Area

This table summarizes the mathematical relationships used to model chemical emission rates from soils and the dispersion of chemical concentrations in air at a distance of 100 meters from the source. The relationships were obtained from the "Superfund Exposure Assessment Manual" (SEAM), 1988. The following defines the column headings: MW, molecular weight; VP, vapor pressure; Csi, saturation vapor concentration; ADV, atomic diffusion volume; Di, diffusion coefficient; Exp. Pnt. Conc., exposure point concentration; Mf, mmoles contaminant per kg soil; Mi, mole fraction (ie. fraction of total moles for each chemical); Ei, estimated emission rate. The following describes the equations and Site specific variables:

$$C_{si} = \frac{VP * MW}{R * T}$$

where:

R = 6.24e+04 (mm Hg-cm<sup>3</sup>/mole-K)  
(T) temperature in degrees K = 293.15

$$E_i = \frac{D_i * C_{si} * A * Pt^{(4/3)} * M_i}{D_{sc}}$$

where:

(A) surface area = 110,000,000 cm<sup>2</sup>  
(Dcs) depth of soil cover = 152 cm  
(Pt) soil porosity = 0.4  
Pt<sup>(4/3)</sup> = 2.95e-01  
^ = exponent

$$D_i = \frac{0.001 * T^{1.75} * ((1/MW) + (1/MW_a))^{(1/2)}}{[(ADV^{(1/3)} + (ADV_a)^{(1/3)})]^2}$$

where:

(MW<sub>a</sub>) molecular wt. of air = 28.8 g/mole  
(ADV<sub>a</sub>) atomic diffusion volume of air = 20.1 cm<sup>3</sup>/mole  
(T) temperature in degrees K = 293.15  
^ = exponent

$$C(x) = \frac{E_i}{(\pi * \sigma_y * \sigma_z * u)} * 0.30$$

where:

C(x) = concentration at distance x  
pi = 3.14  
σ<sub>y</sub> = lateral dispersion coef., stability class D = 8 at 100 m: 35 m  
σ<sub>z</sub> = vertical dispersion coef., stability class D = 4.7 19 m  
u = average wind speed (assume 3 m/s)  
0.3 = assume wind blows 30 % of the time towards receptor

Default equation variables were obtained from SEAM. Refer to SEAM for further information.

Table V-2

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Still Bottoms - Treatment Lagoon Area

COMPOUND	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (Cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	Estimated Downwind Concentration	
										100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
Methylene Chloride	85	3.62e+02	1.69e-03	59.46	0.10151	3.80e+02	4.47e+00	3.48e-03	6.15e-02	5.21e-05	2.94e-06
Acetone	58	2.70e+02	8.60e-04	66.86	0.10245	1.20e+01	2.07e-01	1.61e-04	1.46e-03	1.24e-06	7.00e-08
1,1-Dichloroethane	99	1.82e+02	9.89e-04	79.92	0.08853	2.20e+01	2.22e-01	1.73e-04	1.56e-03	1.32e-06	7.47e-08
Total-1,2-Dichloroethene	97	2.08e+02	1.11e-03	75.96	0.09059	3.20e+02	3.30e+00	2.57e-03	2.65e-02	2.25e-05	1.27e-06
Chloroform	119	1.51e+02	9.86e-04	76.98	0.08818	2.10e+03	1.76e+01	1.37e-02	1.23e-01	1.04e-04	5.89e-06
1,2-Dichloroethane	99	6.40e+01	3.48e-04	79.92	0.08853	4.00e+01	4.04e-01	3.14e-04	9.97e-04	8.45e-07	4.78e-08
2-Butanone	72	7.75e+01	3.06e-04	87.32	0.08890	5.30e+02	7.36e+00	5.73e-03	1.61e-02	1.36e-05	7.70e-07
1,1,1-Trichloroethane	133	1.23e+02	8.98e-04	97.44	0.07917	2.10e+04	1.58e+02	1.23e-01	9.00e-01	7.62e-04	4.31e-05
Carbon Tetrachloride	154	9.00e+01	7.61e-04	94.5	0.07922	3.60e+03	2.34e+01	1.82e-02	1.13e-01	9.57e-05	5.41e-06
1,2-Dichloropropane	113	4.20e+01	2.61e-04	100.38	0.07942	2.20e+01	1.95e-01	1.51e-04	3.23e-04	2.74e-07	1.55e-08
Trichloroethene	131	5.79e+01	4.16e-04	93.48	0.08067	1.70e+03	1.30e+01	1.01e-02	3.49e-02	2.96e-05	1.67e-06
1,1,2-Trichloroethane	133	3.00e+01	2.19e-04	97.44	0.07917	8.10e+00	6.09e-02	4.74e-05	8.47e-05	7.17e-08	4.06e-09
Benzene	78	9.52e+01	4.08e-04	110.88	0.07954	1.70e+02	2.18e+00	1.70e-03	5.67e-03	4.80e-06	2.71e-07
4-Methyl-2-Pentanone	100	6.00e+00	3.29e-05	128.24	0.07247	1.50e+03	1.50e+01	1.17e-02	2.87e-03	2.43e-06	1.37e-07
Tetrachloroethene	166	1.78e+01	1.62e-04	111	0.07360	1.60e+03	9.64e+00	7.50e-03	9.22e-03	7.81e-06	4.42e-07
Toluene	92	2.81e+01	1.42e-04	131.34	0.07242	2.30e+04	2.50e+02	1.94e-01	2.06e-01	1.74e-04	9.86e-06
Chlorobenzene	113	1.17e+01	7.26e-05	128.4	0.07149	2.00e-03	1.77e-05	1.38e-08	7.36e-09	6.24e-12	3.53e-13
Ethylbenzene	106	7.00e+00	4.07e-05	151.8	0.06689	8.40e+03	7.92e+01	6.16e-02	1.73e-02	1.47e-05	8.29e-07
Styrene	104	5.00e+00	2.85e-05	147.84	0.06781	1.60e+02	1.54e+00	1.20e-03	2.39e-04	2.02e-07	1.14e-08
Total Xylenes	106	1.00e+01	5.82e-05	151.8	0.06689	9.40e+03	8.87e+01	6.90e-02	2.77e-02	2.34e-05	1.33e-06
Phenol	94	3.41e-01	1.76e-06	116.36	0.07610	1.09e+02	1.16e+00	8.99e-04	1.24e-05	1.05e-08	5.94e-10
bis(2-Chloroethyl)ether	143	7.10e-01	5.57e-06	126.32	0.07045	1.10e+02	7.69e-01	5.98e-04	2.42e-05	2.05e-08	1.16e-09
2-Chlorophenol	129	5.90e-02	4.18e-07	133.88	0.06932	1.30e-01	1.01e-03	7.84e-07	2.34e-09	1.98e-12	1.12e-13
1,3-Dichlorobenzene	147	2.28e+00	1.84e-05	145.92	0.06600	3.85e-01	2.62e-03	2.04e-06	2.55e-07	2.16e-10	1.22e-11
1,4-Dichlorobenzene	147	1.18e+00	9.52e-06	145.92	0.06600	2.39e+00	1.63e-02	1.27e-05	8.21e-07	6.95e-10	3.93e-11
Benzyl alcohol	108	9.52e+01	5.64e-04	136.82	0.06987	6.88e-01	6.37e-03	4.96e-06	2.01e-05	1.71e-08	9.65e-10
1,2-Dichlorobenzene	147	1.00e+00	8.07e-06	145.92	0.06600	7.00e+01	4.76e-01	3.70e-04	2.03e-05	1.72e-08	9.74e-10
2-Methylphenol	108	2.40e-01	1.42e-06	136.82	0.06987	1.50e+01	1.39e-01	1.08e-04	1.11e-06	9.38e-10	5.30e-11
4-Methylphenol	108	1.10e-01	6.52e-07	136.82	0.06987	4.30e+01	3.98e-01	3.10e-04	1.45e-06	1.23e-09	6.97e-11
Isophorone	138	3.80e-01	2.88e-06	177.74	0.06078	2.60e+03	1.88e+01	1.47e-02	2.64e-04	2.24e-07	1.27e-08
2,4-Dimethylphenol	122	5.90e-02	3.95e-07	157.28	0.06492	1.42e+00	1.16e-02	9.05e-06	2.39e-08	2.03e-11	1.15e-12
Benzoic acid	122	9.52e+01	6.37e-04	138.34	0.06869	3.25e+01	2.67e-01	2.07e-04	9.36e-04	7.93e-07	4.48e-08
2,4-Dichlorophenol	163	5.90e-02	5.28e-07	151.4	0.06442	1.68e+00	1.03e-02	7.99e-06	2.80e-08	2.37e-11	1.34e-12
1,2,4-Trichlorobenzene	181	2.90e-01	2.88e-06	163.44	0.06180	1.44e+00	7.95e-03	6.18e-06	1.13e-07	9.61e-11	5.44e-12
Naphthalene	128	2.60e-04	1.83e-09	180.84	0.06072	7.50e+02	5.86e+00	4.56e-03	5.21e-08	4.41e-11	2.50e-12
Hexachlorobutadiene	261	2.00e+00	2.87e-05	183	0.05750	4.00e+01	1.53e-01	1.19e-04	2.02e-05	1.71e-08	9.70e-10
4-Chloro-3-methylphenol	143	5.90e-02	4.63e-07	137.84	0.06783	3.01e-01	2.11e-03	1.64e-06	5.31e-09	4.50e-12	2.54e-13
2-Methylnaphthalene	142	5.90e-02	4.60e-07	201.3	0.05732	3.20e+02	2.25e+00	1.75e-03	4.76e-06	4.03e-09	2.28e-10
2,4,6-Trichlorophenol	197	1.20e-02	1.30e-07	168.92	0.06056	3.47e-01	1.76e-03	1.37e-06	1.11e-09	9.39e-13	5.31e-14

Table V-2

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Still Bottoms - Treatment Lagoon Area

COMPOUND	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	Estimated Downwind Concentration	
										100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
----- Chemical Emission (Ei) Calculation Variables -----											
2,4,5-Trichlorophenol	197	1.00e+00	1.08e-05	168.92	0.06056	9.60e-02	4.87e-04	3.79e-07	2.56e-08	2.17e-11	1.23e-12
2-Chloronaphthalene	163	5.90e-02	5.28e-07	198.36	0.05707	5.45e-01	3.34e-03	2.60e-06	8.07e-09	6.83e-12	3.86e-13
Dimethylphthalate	194	1.00e-02	1.06e-07	206.72	0.05533	3.20e+02	1.65e+00	1.28e-03	7.79e-07	6.60e-10	3.73e-11
Acenaphthylene	152	2.90e-02	2.42e-07	213.84	0.05545	3.30e+00	2.17e-02	1.69e-05	2.33e-08	1.98e-11	1.12e-12
Acenaphthene	154	1.55e-03	1.31e-08	217.8	0.05492	2.33e+00	1.52e-02	1.18e-05	8.74e-10	7.40e-13	4.19e-14
4-Nitrophenol	139	5.90e-02	4.50e-07	131.03	0.06951	1.52e+00	1.09e-02	8.49e-06	2.74e-08	2.32e-11	1.31e-12
Dibenzofuran	170	2.00e-02	1.87e-07	223.28	0.05390	3.42e-01	2.01e-03	1.56e-06	1.62e-09	1.37e-12	7.76e-14
Diethylphthalate	222	3.50e-03	4.26e-08	247.64	0.05049	1.00e+02	4.50e-01	3.50e-04	7.78e-08	6.59e-11	3.72e-12
Fluorene	116	7.10e-04	4.52e-09	234.3	0.05446	5.07e+00	4.37e-02	3.40e-05	8.62e-10	7.31e-13	4.13e-14
N-Nitrosodiphenylamine	198	3.80e-05	4.13e-10	234.66	0.05213	1.30e+01	6.57e-02	5.11e-05	1.13e-10	9.60e-14	5.43e-15
4-Bromophenyl-phenylether	249	2.00e-02	2.73e-07	260.26	0.04903	9.23e-01	3.71e-03	2.88e-06	3.99e-09	3.38e-12	1.91e-13
Hexachlorobenzene	285	1.09e-05	1.71e-10	216	0.05310	7.16e-01	2.51e-03	1.95e-06	1.82e-12	1.55e-15	8.74e-17
Pentachlorophenol	266	1.10e-04	1.61e-09	203.96	0.05469	6.40e+01	2.41e-01	1.87e-04	1.69e-09	1.44e-12	8.11e-14
Phenanthrene	178	6.80e-04	6.64e-09	250.8	0.05091	1.00e+01	5.62e-02	4.37e-05	1.52e-09	1.29e-12	7.30e-14
Anthracene	178	1.95e-04	1.91e-09	250.8	0.05091	9.53e-01	5.35e-03	4.16e-06	4.16e-11	3.53e-14	1.99e-15
Di-n-butylphthalate	278	1.00e-05	1.53e-10	329.48	0.04362	6.90e+02	2.48e+00	1.93e-03	1.32e-09	1.12e-12	6.34e-14
Fluoranthene	202	5.00e-06	5.54e-11	283.8	0.04764	6.10e-01	3.02e-03	2.35e-06	6.39e-13	5.42e-16	3.06e-17
Pyrene	202	2.50e-06	2.77e-11	283.8	0.04764	1.70e+00	8.40e-03	6.54e-06	8.89e-13	7.53e-16	4.26e-17
Butylbenzylphthalate	312	8.60e+06	1.47e+02	375.02	0.04077	9.60e+02	3.08e+00	2.39e-03	1.48e+03	1.25e+00	7.09e-02
Benzo(a)anthracene	228	2.20e-08	2.75e-13	320.76	0.04463	3.21e-01	1.41e-03	1.10e-06	1.39e-15	1.18e-18	6.65e-20
Chrysene	228	6.30e-09	7.88e-14	320.76	0.04463	2.96e-01	1.30e-03	1.01e-06	3.67e-16	3.10e-19	1.76e-20
bis(2-Ethylhexyl)phthalat	391	8.60e+06	1.85e+02	493.16	0.03535	2.60e+03	6.65e+00	5.17e-03	3.48e+03	2.95e+00	1.67e-01
Di-n-octylphthalate	391	8.60e+06	1.85e+02	493.16	0.03535	1.95e+01	4.99e-02	3.88e-05	2.61e+01	2.21e-02	1.25e-03
Benzo(b)fluoranthene	252	5.00e-07	6.92e-12	353.76	0.04236	3.20e-01	1.27e-03	9.86e-07	2.98e-14	2.52e-17	1.43e-18
Benzo(k)fluoranthene	252	5.10e-07	7.05e-12	353.76	0.04236	3.20e-01	1.27e-03	9.86e-07	3.04e-14	2.57e-17	1.45e-18
Benzo(a)pyrene	252	5.60e-09	7.75e-14	353.76	0.04236	2.15e-01	8.52e-04	6.63e-07	2.24e-16	1.90e-19	1.07e-20
Gamma-BHC (Lindane)	291	1.60e+04	2.56e-01	110.88	0.07125	1.10e+00	3.78e-03	2.94e-06	5.52e-03	4.67e-06	2.64e-07
Endosulfan 1	407	5.50e-06	1.23e-10	310.82	0.04417	1.20e+00	2.95e-03	2.29e-06	1.28e-12	1.09e-15	6.15e-17
4,4-DDT	355	5.50e-06	1.07e-10	346.32	0.04215	2.80e+01	7.89e-02	6.14e-05	2.86e-11	2.42e-14	1.37e-15
Endrin Ketone	381	1.78e-07	3.72e-12	336.32	0.04264	2.60e-01	6.82e-04	5.31e-07	8.68e-15	7.36e-18	4.16e-19
TOTAL PCBs	328	7.70e-05	1.39e-09	235.32	0.05074	1.58e+02	4.82e-01	3.75e-04	2.72e-09	2.30e-12	1.30e-13
Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	3.80e+02	3.17e+00	2.46e-03	3.34e-04	2.83e-07	1.60e-08
Propenyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	6.70e+01	5.58e-01	4.34e-04	5.89e-05	4.99e-08	2.82e-09
Ethyl Methyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	1.90e+03	1.58e+01	1.23e-02	1.67e-03	1.42e-06	8.00e-08
Diethyl Benzenes	106	7.00e+00	4.07e-05	151.8	0.06689	5.10e+02	4.81e+00	3.74e-03	1.05e-03	8.90e-07	5.03e-08
Methyl Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	1.10e+03	9.17e+00	7.13e-03	9.67e-04	8.19e-07	4.63e-08
Methyl Phenyl Benzenes	128	2.60e-04	1.83e-09	180.84	0.06072	3.10e+01	2.42e-01	1.88e-04	2.15e-09	1.82e-12	1.03e-13
Trimethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	1.80e+03	1.50e+01	1.17e-02	4.95e-02	4.19e-05	2.37e-06
Dimethyl ethyl benzenes	106	7.00e+00	4.07e-05	151.8	0.06689	1.90e+03	1.79e+01	1.39e-02	3.92e-03	3.32e-06	1.88e-07

Table V-2

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Still Bottoms - Treatment Lagoon Area

COMPOUND	----- Chemical Emission (Ei) Calculation Variables -----									Estimated Downwind Concentration	
	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (Cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
Tetramethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	1.30e+03	1.08e+01	8.43e-03	3.57e-02	3.03e-05	1.71e-06
Oxygenated Benzenes	106	1.00e+02	5.82e-04	132.86	0.07091	1.00e+02	9.43e-01	7.34e-04	3.12e+03	2.64e-06	1.49e-07
Nitrogenated Benzenes	123	1.50e-01	1.01e-06	125.55	0.07159	2.50e+02	2.03e+00	1.58e-03	1.18e-05	1.00e-08	5.66e-10
Cyclic alkanes	98	1.44e+02	7.75e-04	131.34	0.07189	5.80e+03	5.92e+01	4.60e-02	2.64e-01	2.24e-04	1.27e-05
Cyclic Alkenes	98	1.44e+02	7.75e-04	131.34	0.07189	1.20e+03	1.22e+01	9.53e-03	5.47e-02	4.63e-05	2.62e-06
Halogenated Alkanes	133	1.23e+02	8.98e-04	97.44	0.07917	4.80e+03	3.61e+01	2.81e-02	2.06e-01	1.74e-04	9.85e-06
n-chain Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	2.30e+04	2.67e+02	2.08e-01	9.54e-01	8.08e-04	4.57e-05
Branched Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	5.90e+03	6.86e+01	5.34e-02	2.45e-01	2.07e-04	1.17e-05
Branched Alkenes/Alkynes	86	1.20e+02	5.66e-04	110.88	0.07853	2.60e+03	3.02e+01	2.35e-02	1.08e-01	9.13e-05	5.16e-06
Methylated Naphthalenes	108	2.40e-01	1.83e-09	180.84	0.06072	5.70e+01	5.28e-01	4.11e-04	4.69e-09	3.98e-12	2.25e-13
Phthalates	148	2.00e-04	1.62e-09	156.36	0.06399	5.80e+01	3.92e-01	3.05e-04	3.27e-09	2.77e-12	1.56e-13
Methylated Phenols	108	2.40e-01	1.42e-06	136.82	0.06987	7.20e-01	6.67e-03	5.19e-06	5.31e-08	4.50e-11	2.54e-12
Methylated Ketones	58	2.70e+02	8.60e-04	66.86	0.10245	1.60e+00	2.76e-02	2.15e-05	1.95e-04	1.65e-07	9.33e-09
Simple Ketones	72	7.75e+01	3.06e-04	87.32	0.08890	7.70e-01	1.07e-02	8.32e-06	2.33e-05	1.98e-08	1.12e-09
Cyclic Ketones	138	3.80e-01	2.88e-06	177.74	0.06078	1.60e+02	1.16e+00	9.02e-04	1.63e-05	1.38e-08	7.79e-10
Diols	62	5.00e-02	1.70e-07	55.84	0.10881	3.00e+00	4.84e-02	3.76e-05	7.18e-08	6.08e-11	3.44e-12
Simple Alcohols	74	4.40e+00	1.79e-05	91.28	0.08694	5.50e+01	7.43e-01	5.78e-04	9.26e-05	7.84e-08	4.43e-09
Cyclic Alcohols	108	1.00e+00	5.93e-06	136.82	0.06987	1.50e+01	1.39e-01	1.08e-04	4.61e-06	3.91e-09	2.21e-10
Oxygenated Alcohols	118	6.00e-01	3.89e-06	137.68	0.06906	2.80e+02	2.37e+00	1.85e-03	5.11e-05	4.32e-08	2.45e-09
Non-Cyclic Acids	72	3.20e+00	1.26e-05	68.38	0.09820	3.10e+02	4.31e+00	3.35e-03	4.29e-04	3.63e-07	2.05e-08
Amines	113	1.00e-03	6.20e-09	131.95	0.07065	1.40e+02	1.24e+00	9.64e-04	4.35e-08	3.69e-11	2.08e-12
Furans	72	1.31e+02	5.18e-04	87.32	0.08890	4.40e-01	6.11e-03	4.75e-06	2.26e-05	1.91e-08	1.08e-09

Table V-2

VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Still Bottoms - Treatment Lagoon Area

This table summarizes the mathematical relationships used to model chemical emission rates from soils and the dispersion of chemical concentrations in air at a distance of 100 meters from the source. The relationships were obtained from the "Superfund Exposure Assessment Manual" (SEAM), 1988. The following defines the column headings: MW, molecular weight; VP, vapor pressure; Csi, saturation vapor concentration; ADV, atomic diffusion volume; Di, diffusion coefficient; Exp. Pnt. Conc., exposure point concentration; Mf, mmoles contaminant per kg soil; Mi, mole fraction (ie. fraction of total moles for each chemical); Ei, estimated emission rate. The following describes the equations and Site specific variables:

$$C_{si} = \frac{VP * MW}{R * T}$$

where:

R = 6.24e+04 (mm Hg-cm<sup>3</sup>/mole-K)  
(T) temperature in degrees K = 293.15

$$E_i = \frac{D_i * C_{si} * A * P_t^{(4/3)} * M_i}{D_{sc}}$$

where:

(A) surface area = 64,000,000 cm<sup>2</sup>  
(D<sub>sc</sub>) depth of soil cover = 183 cm  
(P<sub>t</sub>) soil porosity = 0.4  
P<sub>t</sub><sup>(4/3)</sup> = 2.95e-01  
^ = exponent

$$D_i = \frac{0.001 * T^{1.75} * ((1/MW) + (1/MW_a))^{(1/2)}}{[(ADV^{(1/3)} + (ADV_a)^{(1/3)})]^2}$$

where:

(MW<sub>a</sub>) molecular wt. of air = 28.8 g/mole  
(ADV<sub>a</sub>) atomic diffusion volume of air = 20.1 cm<sup>3</sup>/mole  
(T) temperature in degrees K = 293.15  
^ = exponent

$$C(x) = \frac{E_i}{(\pi * O_y * O_z * u)} * 0.30$$

where:

C(x) = concentration at distance x  
π = 3.14  
O<sub>y</sub> = lateral dispersion coef., stability class D = 8 at 100 m: 35 m  
O<sub>z</sub> = vertical dispersion coef., stability class D = 4.7 at 100 m: 19 m  
u = average wind speed (assume 3 m/s)  
0.3 = assume wind blows 30 % of the time towards receptor

Default equation variables were obtained from SEAM. Refer to SEAM for further information.

Table V-3

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Offsite Containment Area

COMPOUND	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (Cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	Estimated Downwind Concentration	
										100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
----- Chemical Emission (Ei) Calculation Variables -----											
Vinyl Chloride	63	2.66e+03	9.20e-03	58.44	0.10662	2.90e+00	4.60e-02	5.80e-06	8.00e-04	6.78e-07	3.83e-08
Chloroethane	51	3.80e+03	1.06e-02	62.4	0.10767	2.00e+00	3.92e-02	4.94e-06	7.96e-04	6.74e-07	3.81e-08
Methylene Chloride	85	3.62e+02	1.69e-03	59.46	0.10151	2.10e+02	2.47e+00	3.11e-04	7.51e-03	6.36e-06	3.60e-07
Acetone	58	2.70e+02	8.60e-04	66.86	0.10245	1.71e+04	2.95e+02	3.71e-02	4.60e-01	3.89e-04	2.20e-05
1,1-Dichloroethene	97	6.00e+02	3.19e-03	75.96	0.09059	3.90e+02	4.02e+00	5.06e-04	2.06e-02	1.75e-05	9.88e-07
1,1-Dichloroethane	99	1.82e+02	9.89e-04	79.92	0.08853	4.90e+02	4.95e+00	6.23e-04	7.68e-03	6.51e-06	3.68e-07
Total-1,2-Dichloroethene	97	2.08e+02	1.11e-03	75.96	0.09059	3.40e+01	3.51e-01	4.41e-05	6.23e-04	5.28e-07	2.99e-08
Chloroform	119	1.51e+02	9.86e-04	76.98	0.08818	2.80e+03	2.35e+01	2.96e-03	3.63e-02	3.07e-05	1.74e-06
1,2-Dichloroethane	99	6.40e+01	3.48e-04	79.92	0.08853	4.40e+02	4.44e+00	5.60e-04	2.43e-03	2.05e-06	1.16e-07
2-Butanone	72	7.75e+01	3.06e-04	87.32	0.08890	9.90e+04	1.38e+03	1.73e-01	6.64e-01	5.62e-04	3.18e-05
1,1,1-Trichloroethane	133	1.23e+02	8.98e-04	97.44	0.07917	1.50e+05	1.13e+03	1.42e-01	1.42e+00	1.20e-03	6.81e-05
1,2-Dichloropropane	113	4.20e+01	2.61e-04	100.38	0.07942	6.80e+01	6.02e-01	7.58e-05	2.21e-04	1.87e-07	1.06e-08
Trichloroethene	131	5.79e+01	4.16e-04	93.48	0.08067	1.90e+04	1.45e+02	1.83e-02	8.63e-02	7.31e-05	4.14e-06
1,1,2-Trichloroethane	133	3.00e+01	2.19e-04	97.44	0.07917	4.00e+02	3.01e+00	3.79e-04	9.24e-04	7.83e-07	4.43e-08
Benzene	78	9.52e+01	4.08e-04	110.88	0.07954	1.50e+03	1.92e+01	2.42e-03	1.11e-02	9.36e-06	5.29e-07
4-Methyl-2-Pentanone	100	6.00e+00	3.29e-05	128.24	0.07247	6.10e+04	6.10e+02	7.68e-02	2.58e-02	2.19e-05	1.24e-06
2-Hexanone	100	2.00e+00	1.10e-05	128.24	0.07247	4.70e+01	4.70e-01	5.92e-05	6.63e-06	5.61e-09	3.17e-10
Tetrachloroethene	166	1.78e+01	1.62e-04	111	0.07360	4.60e+04	2.77e+02	3.49e-02	5.86e-02	4.97e-05	2.81e-06
1,1,2,2-Tetrachloroethane	168	5.00e+00	4.61e-05	114.96	0.07244	8.93e-03	5.32e-05	6.70e-09	3.15e-09	2.67e-12	1.51e-13
Toluene	92	2.81e+01	1.42e-04	131.34	0.07242	1.30e+05	1.41e+03	1.78e-01	2.57e-01	2.18e-04	1.23e-05
Chlorobenzene	113	1.17e+01	7.26e-05	128.4	0.07149	1.00e+03	8.85e+00	1.11e-03	8.14e-04	6.89e-07	3.90e-08
Ethylbenzene	106	7.00e+00	4.07e-05	151.8	0.06689	2.30e+04	2.17e+02	2.73e-02	1.05e-02	8.88e-06	5.02e-07
Styrene	104	5.00e+00	2.85e-05	147.84	0.06781	3.10e+02	2.98e+00	3.75e-04	1.02e-04	8.66e-08	4.90e-09
Total Xylenes	106	1.00e+01	5.82e-05	151.8	0.06689	1.00e+05	9.43e+02	1.19e-01	6.51e-02	5.51e-05	3.12e-06
Phenol	94	3.41e-01	1.76e-06	116.36	0.07610	5.12e+02	5.45e+00	6.86e-04	1.29e-05	1.10e-08	6.19e-10
bis(2-Chloroethyl)ether	143	7.10e-01	5.57e-06	126.32	0.07045	2.00e+02	1.40e+00	1.76e-04	9.73e-06	8.24e-09	4.66e-10
1,4-Dichlorobenzene	147	1.18e+00	9.52e-06	145.92	0.06600	5.52e+00	3.75e-02	4.72e-06	4.18e-07	3.54e-10	2.00e-11
Benzyl alcohol	108	9.52e+01	5.64e-04	136.82	0.06987	3.40e+01	3.15e-01	3.96e-05	2.20e-04	1.86e-07	1.05e-08
1,2-Dichlorobenzene	147	1.00e+00	8.07e-06	145.92	0.06600	1.20e+02	8.16e-01	1.03e-04	7.71e-06	6.53e-09	3.69e-10
2-Methylphenol	108	2.40e-01	1.42e-06	136.82	0.06987	6.78e+01	6.28e-01	7.91e-05	1.11e-06	9.38e-10	5.30e-11
4-Methylphenol	108	1.10e-01	6.52e-07	136.82	0.06987	2.10e+02	1.94e+00	2.45e-04	1.57e-06	1.33e-09	7.52e-11
Isophorone	138	3.80e-01	2.88e-06	177.74	0.06078	3.60e+03	2.61e+01	3.29e-03	8.09e-05	6.85e-08	3.87e-09
2,4-Dimethylphenol	122	5.90e-02	3.95e-07	157.28	0.06492	1.16e+02	9.54e-01	1.20e-04	4.34e-07	3.67e-10	2.08e-11
Benzoic acid	122	9.52e+01	6.37e-04	138.34	0.06869	1.17e+04	9.59e+01	1.21e-02	7.45e-02	6.31e-05	3.57e-06
2,4-Dichlorophenol	163	5.90e-02	5.28e-07	151.4	0.06442	2.00e-01	1.23e-03	1.55e-07	7.40e-10	6.26e-13	3.54e-14
1,2,4-Trichlorobenzene	181	2.90e-01	2.88e-06	163.44	0.06180	3.44e+01	1.90e-01	2.39e-05	6.00e-07	5.08e-10	2.87e-11
Naphthalene	128	2.60e-04	1.83e-09	180.84	0.06072	2.40e+03	1.88e+01	2.36e-03	3.69e-08	3.12e-11	1.77e-12
Hexachlorobutadiene	261	2.00e+00	2.87e-05	183	0.05750	1.50e+02	5.75e-01	7.24e-05	1.68e-05	1.42e-08	8.04e-10
2-Methylnaphthalene	142	5.90e-02	4.60e-07	201.3	0.05732	9.90e+02	6.97e+00	8.78e-04	3.26e-06	2.76e-09	1.56e-10

Table V-3

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Offsite Containment Area

COMPOUND	----- Chemical Emission (Ei) Calculation Variables -----									Estimated Downwind Concentration	
	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (Cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
Dimethylphthalate	194	1.00e-02	1.06e-07	206.72	0.05533	5.22e+02	2.69e+00	3.39e-04	2.81e-07	2.38e-10	1.34e-11
Acenaphthylene	152	2.90e-02	2.42e-07	213.84	0.05545	1.90e+00	1.25e-02	1.58e-06	2.98e-09	2.52e-12	1.43e-13
2,6-Dinitrotoluene	182	1.80e-02	1.80e-07	160.68	0.06225	7.49e-01	4.12e-03	5.18e-07	8.17e-10	6.92e-13	3.91e-14
Acenaphthene	154	1.55e-03	1.31e-08	217.8	0.05492	1.80e+01	1.17e-01	1.47e-05	1.49e-09	1.26e-12	7.14e-14
4-Nitrophenol	139	5.90e-02	4.50e-07	131.03	0.06951	3.11e+00	2.24e-02	2.82e-06	1.24e-08	1.05e-11	5.95e-13
Dibenzofuran	170	2.00e-02	1.87e-07	223.28	0.05390	4.16e+00	2.45e-02	3.08e-06	4.36e-09	3.69e-12	2.09e-13
Diethylphthalate	222	3.50e-03	4.26e-08	247.64	0.05049	2.80e+02	1.26e+00	1.59e-04	4.81e-08	4.08e-11	2.31e-12
Fluorene	116	7.10e-04	4.52e-09	234.3	0.05446	3.10e+01	2.67e-01	3.37e-05	1.17e-09	9.88e-13	5.59e-14
N-Nitrosodiphenylamine	198	3.80e-05	4.13e-10	234.66	0.05213	5.30e+01	2.68e-01	3.37e-05	1.02e-10	8.65e-14	4.89e-15
Hexachlorobenzene	285	1.09e-05	1.71e-10	216	0.05310	1.92e+00	6.74e-03	8.49e-07	1.08e-12	9.17e-16	5.18e-17
Pentachlorophenol	266	1.10e-04	1.61e-09	203.96	0.05469	1.80e+02	6.77e-01	8.52e-05	1.05e-09	8.92e-13	5.05e-14
Phenanthrene	178	6.80e-04	6.64e-09	250.8	0.05091	4.30e+01	2.42e-01	3.04e-05	1.45e-09	1.23e-12	6.94e-14
Anthracene	178	1.95e-04	1.91e-09	250.8	0.05091	6.87e-01	3.86e-03	4.86e-07	6.64e-12	5.62e-15	3.18e-16
Di-n-butylphthalate	278	1.00e-05	1.53e-10	329.48	0.04362	3.40e+03	1.22e+01	1.54e-03	1.44e-09	1.22e-12	6.91e-14
Fluoranthene	202	5.00e-06	5.54e-11	283.8	0.04764	1.68e+01	8.33e-02	1.05e-05	3.90e-12	3.30e-15	1.87e-16
Pyrene	202	2.50e-06	2.77e-11	283.8	0.04764	2.20e+01	1.09e-01	1.37e-05	2.55e-12	2.16e-15	1.22e-16
Butylbenzylphthalate	312	8.60e+06	1.47e+02	375.02	0.04077	1.60e+03	5.13e+00	6.46e-04	5.46e+02	4.62e-01	2.61e-02
Benzo(a)anthracene	228	2.20e-08	2.75e-13	320.76	0.04463	1.60e+01	7.02e-02	8.84e-06	1.53e-14	1.29e-17	7.32e-19
Chrysene	228	6.30e-09	7.88e-14	320.76	0.04463	1.75e+01	7.69e-02	9.69e-06	4.80e-15	4.06e-18	2.30e-19
bis(2-Ethylhexyl)phthalat	391	8.60e+06	1.85e+02	493.16	0.03535	1.40e+04	3.58e+01	4.51e-03	4.14e+03	3.51e+00	1.98e-01
Di-n-octylphthalate	391	8.60e+06	1.85e+02	493.16	0.03535	1.40e+02	3.58e-01	4.51e-05	4.14e+01	3.51e-02	1.98e-03
Benzo(b)fluoranthene	252	5.00e-07	6.92e-12	353.76	0.04236	1.50e+01	5.95e-02	7.50e-06	3.09e-13	2.62e-16	1.48e-17
Benzo(k)fluoranthene	252	5.10e-07	7.05e-12	353.76	0.04236	1.50e+01	5.95e-02	7.50e-06	3.15e-13	2.67e-16	1.51e-17
Benzo(a)pyrene	252	5.60e-09	7.75e-14	353.76	0.04236	2.24e+00	8.89e-03	1.12e-06	5.17e-16	4.38e-19	2.48e-20
Indeno(1,2,3-cd)pyrene	276	1.00e-10	1.51e-15	386.76	0.04039	8.17e-01	2.96e-03	3.73e-07	3.21e-18	2.72e-21	1.54e-22
Dibenz(a,h)anthracene	278	1.00e-10	1.53e-15	390.72	0.04017	1.90e-01	6.83e-04	8.61e-08	7.43e-19	6.29e-22	3.56e-23
Benzo(g,h,i)perylene	276	1.03e-10	1.56e-15	386.76	0.04039	6.23e-01	2.26e-03	2.84e-07	2.52e-18	2.14e-21	1.21e-22
Alpha-BHC	291	2.50e-05	3.99e-10	110.88	0.07125	1.83e-01	6.27e-04	7.90e-08	3.16e-13	2.68e-16	1.52e-17
Beta-BHC	291	2.80e-07	4.47e-12	110.88	0.07125	5.21e-01	1.79e-03	2.26e-07	1.01e-14	8.57e-18	4.85e-19
Aldrin	365	6.00e-06	1.20e-10	330.84	0.04304	8.98e-01	2.46e-03	3.10e-07	2.26e-13	1.91e-16	1.08e-17
Heptachlor Epoxide	389	3.00e-04	6.41e-09	311.4	0.04420	6.35e-03	1.63e-05	2.06e-09	8.19e-14	6.94e-17	3.92e-18
4,4-DDE	318	6.50e-06	1.13e-10	324.84	0.04365	4.50e-01	1.41e-03	1.78e-07	1.24e-13	1.05e-16	5.95e-18
4,4-DDD	320	1.89e-06	3.32e-11	385.68	0.04018	1.35e+00	4.23e-03	5.33e-07	1.00e-13	8.48e-17	4.79e-18
4,4-DDT	355	5.50e-06	1.07e-10	346.32	0.04215	8.91e-01	2.51e-03	3.16e-07	2.01e-13	1.70e-16	9.63e-18
TOTAL PCBs	328	7.70e-05	1.39e-09	235.32	0.05074	4.51e+02	1.37e+00	1.73e-04	1.71e-09	1.45e-12	8.21e-14
Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	5.20e+02	4.33e+00	5.46e-04	1.01e-04	8.56e-08	4.84e-09
Propenyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	1.20e+02	1.00e+00	1.26e-04	2.33e-05	1.98e-08	1.12e-09
Ethyl Methyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	5.90e+03	4.92e+01	6.19e-03	1.15e-03	9.72e-07	5.49e-08
Diethyl Benzenes	106	7.00e+00	4.07e-05	151.8	0.06689	2.20e+03	2.08e+01	2.61e-03	1.00e-03	8.49e-07	4.80e-08

Table V-3

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Offsite Containment Area

COMPOUND	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	DI @ 19 C (cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	Estimated Downwind Concentration	
										100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
Methyl Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	9.40e+02	7.83e+00	9.86e-04	1.83e-04	1.55e-07	8.75e-09
Trimethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	9.80e+03	8.17e+01	1.03e-02	5.95e-02	5.04e-05	2.85e-06
Dimethyl ethyl benzenes	106	7.00e+00	4.07e-05	151.8	0.06689	1.70e+03	1.60e+01	2.02e-03	7.74e-04	6.56e-07	3.71e-08
Tetramethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	2.90e+02	2.42e+00	3.04e-04	1.76e-03	1.49e-06	8.44e-08
Oxygenated Benzenes	106	1.00e+02	5.82e-04	132.86	0.07091	3.50e+03	3.30e+01	4.16e-03	2.41e-02	2.05e-05	1.16e-06
Nitrogenated Benzenes	123	1.50e-01	1.01e-06	125.55	0.07159	9.90e+02	8.05e+00	1.01e-03	1.03e-05	8.76e-09	4.95e-10
Cyclic alkanes	98	1.44e+02	7.75e-04	131.34	0.07189	9.90e+01	1.01e+00	1.27e-04	9.97e-04	8.45e-07	4.78e-08
Cyclic Alkenes	98	1.44e+02	7.75e-04	131.34	0.07189	4.70e+02	4.80e+00	6.04e-04	4.73e-03	4.01e-06	2.27e-07
n-chain Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	1.30e+03	1.51e+01	1.90e-03	1.19e-02	1.01e-05	5.71e-07
Branched Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	2.30e+03	2.67e+01	3.37e-03	2.11e-02	1.79e-05	1.01e-06
Branched Alkenes/Alkynes	86	1.20e+02	5.66e-04	110.88	0.07853	1.40e+02	1.63e+00	2.05e-04	1.28e-03	1.09e-06	6.15e-08
Ethers	74	4.42e+02	1.80e-03	91.28	0.08694	9.20e+01	1.24e+00	1.57e-04	3.44e-03	2.91e-06	1.65e-07
Methylated Naphthalenes	108	2.40e-01	1.83e-09	180.84	0.06072	7.30e+02	6.76e+00	8.51e-04	1.33e-08	1.13e-11	6.36e-13
Phthalates	148	2.00e-04	1.62e-09	156.36	0.06399	1.20e+03	8.11e+00	1.02e-03	1.49e-08	1.27e-11	7.16e-13
Methylated Phenols	108	2.40e-01	1.42e-06	136.82	0.06987	5.40e+01	5.00e-01	6.30e-05	8.81e-07	7.46e-10	4.22e-11
Methylated Ketones	58	2.70e+02	8.60e-04	66.86	0.10245	1.00e+02	1.72e+00	2.17e-04	2.69e-03	2.28e-06	1.29e-07
Simple Ketones	72	7.75e+01	3.06e-04	87.32	0.08890	9.10e-01	1.26e-02	1.59e-06	6.10e-06	5.17e-09	2.92e-10
Cyclic Ketones	138	3.80e-01	2.88e-06	177.74	0.06078	8.00e+01	5.80e-01	7.30e-05	1.80e-06	1.52e-09	8.61e-11
Diols	62	5.00e-02	1.70e-07	55.84	0.10881	2.60e+03	4.19e+01	5.28e-03	1.38e-05	1.17e-08	6.59e-10
Simple Alcohols	74	4.40e+00	1.79e-05	91.28	0.08694	4.80e+02	6.49e+00	8.17e-04	1.79e-04	1.51e-07	8.56e-09
Cyclic Alcohols	108	1.00e+00	5.93e-06	136.82	0.06987	1.30e+01	1.20e-01	1.52e-05	8.84e-07	7.49e-10	4.23e-11
Oxygenated Alcohols	118	6.00e-01	3.89e-06	137.68	0.06906	2.40e+03	2.03e+01	2.56e-03	9.68e-05	8.20e-08	4.63e-09
Cyclic Acids	122	9.50e+01	6.36e-04	138.34	0.06869	7.80e+01	6.39e-01	8.05e-05	4.95e-04	4.19e-07	2.37e-08
Non-Cyclic Acids	72	3.20e+00	1.26e-05	68.38	0.09820	6.30e+04	8.75e+02	1.10e-01	1.93e-02	1.63e-05	9.23e-07
Amines	113	1.00e-03	6.20e-09	131.95	0.07065	5.30e+02	4.69e+00	5.91e-04	3.64e-08	3.09e-11	1.74e-12
Furans	72	1.31e+02	5.18e-04	87.32	0.08890	3.10e-01	4.31e-03	5.42e-07	3.51e-06	2.98e-09	1.68e-10

Table V-3

VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Offsite Containment Area

This table summarizes the mathematical relationships used to model chemical emission rates from soils and the dispersion of chemical concentrations in air at a distance of 100 meters from the source. The relationships were obtained from the "Superfund Exposure Assessment Manual" (SEAM), 1988. The following defines the column headings: MW, molecular weight; VP, vapor pressure; Csi, saturation vapor concentration; ADV, atomic diffusion volume; Di, diffusion coefficient; Exp. Pnt. Conc., exposure point concentration; Mf, mmoles contaminant per kg soil; Mi, mole fraction (ie. fraction of total moles for each chemical); Ei, estimated emission rate. The following describes the equations and Site specific variables:

$$C_{si} = \frac{VP * MW}{R * T}$$

where:

R = 6.24e+04 (mm Hg-cm<sup>3</sup>/mole-K)  
(T) temperature in degrees K = 293.15

$$E_i = \frac{D_i * C_{si} * A * P_t^{(4/3)} * M_i}{D_{sc}}$$

where:

(A) surface area = 1.60e+08 cm<sup>2</sup>  
(D<sub>sc</sub>) depth of soil cover = 335 cm  
(P<sub>t</sub>) soil porosity = 0.4  
P<sub>t</sub><sup>(4/3)</sup> = 2.95e-01  
^ = exponent

$$D_i = \frac{0.001 * T^{1.75} * ((1/MW) + (1/MW_a))^{(1/2)}}{[(ADV^{(1/3)} + (ADV_a^{(1/3)}))]^2}$$

where:

(MW<sub>a</sub>) molecular wt. of air = 28.8 g/mole  
(ADV<sub>a</sub>) atomic diffusion volume of air = 20.1 cm<sup>3</sup>/mole  
(T) temperature in degrees K = 293.15  
^ = exponent

$$C(x) = \frac{E_i}{(\pi * O_y * O_z * u)} * 0.30$$

where:

C(x) = concentration at distance x  
π = 3.14 at 100 m:  
O<sub>y</sub> = lateral dispersion coef., stability class D = 8 35 m  
O<sub>z</sub> = vertical dispersion coef., stability class D = 4.7 19 m  
u = average wind speed (assume 3 m/s)  
0.3 = assume wind blows 30 % of the time towards receptor

Default equation variables were obtained from SEAM. Refer to SEAM for further information.

Table V-4

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Kapica-Pazmey Surface Soil

COMPOUND	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (Cm <sup>2</sup> /sec)	Chemical Emission (Ei) Calculation Variables				Estimated Downwind Concentration	
						Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
Methylene Chloride	85	3.62e+02	1.69e-03	59.46	0.10151	2.00e-01	2.35e-03	4.74e-06	2.12e-04	1.80e-07	1.02e-08
Acetone	58	2.70e+02	8.60e-04	66.86	0.10245	9.70e-01	1.67e-02	3.37e-05	7.75e-04	6.57e-07	3.71e-08
1,1-Dichloroethane	99	1.82e+02	9.89e-04	79.92	0.08853	1.50e-01	1.52e-03	3.05e-06	6.98e-05	5.92e-08	3.34e-09
Total-1,2-Dichloroethene	97	2.08e+02	1.11e-03	75.96	0.09059	7.60e+00	7.84e-02	1.58e-04	4.14e-03	3.51e-06	1.98e-07
Chloroform	119	1.51e+02	9.86e-04	76.98	0.08818	1.00e-02	8.40e-05	1.69e-07	3.85e-06	3.26e-09	1.84e-10
1,1,1-Trichloroethane	133	1.23e+02	8.98e-04	97.44	0.07917	9.00e-03	6.77e-05	1.36e-07	2.53e-06	2.15e-09	1.21e-10
1,2-Dichloropropane	113	4.20e+01	2.61e-04	100.38	0.07942	1.90e-02	1.68e-04	3.39e-07	1.83e-06	1.55e-09	8.77e-11
Trichloroethene	131	5.79e+01	4.16e-04	93.48	0.08067	1.70e+02	1.30e+00	2.61e-03	2.29e-02	1.94e-05	1.10e-06
Benzene	78	9.52e+01	4.08e-04	110.88	0.07954	3.20e+00	4.10e-02	8.26e-05	7.00e-04	5.93e-07	3.35e-08
4-Methyl-2-Pentanone	100	6.00e+00	3.29e-05	128.24	0.07247	2.70e+02	2.70e+00	5.44e-03	3.39e-03	2.87e-06	1.62e-07
Tetrachloroethene	166	1.78e+01	1.62e-04	111	0.07360	7.90e+02	4.76e+00	9.59e-03	2.99e-02	2.53e-05	1.43e-06
Toluene	92	2.81e+01	1.42e-04	131.34	0.07242	1.90e+04	2.07e+02	4.16e-01	1.12e+00	9.46e-04	5.35e-05
Chlorobenzene	113	1.17e+01	7.26e-05	128.4	0.07149	6.20e+00	5.49e-02	1.11e-04	1.50e-04	1.27e-07	7.18e-09
Ethylbenzene	106	7.00e+00	4.07e-05	151.8	0.06689	4.30e+03	4.06e+01	8.17e-02	5.82e-02	4.93e-05	2.79e-06
Styrene	104	5.00e+00	2.85e-05	147.84	0.06781	2.30e+01	2.21e-01	4.46e-04	2.25e-04	1.91e-07	1.08e-08
Total Xylenes	106	1.00e+01	5.82e-05	151.8	0.06689	2.30e+04	2.17e+02	4.37e-01	4.45e-01	3.77e-04	2.13e-05
Phenol	94	3.41e-01	1.76e-06	116.36	0.07610	2.80e+01	2.98e-01	6.00e-04	2.10e-05	1.78e-08	1.01e-09
1,2-Dichlorobenzene	147	1.00e+00	8.07e-06	145.92	0.06600	5.90e-01	4.01e-03	8.09e-06	1.13e-06	9.53e-10	5.39e-11
2-Methylphenol	108	2.40e-01	1.42e-06	136.82	0.06987	4.70e+00	4.35e-02	8.77e-05	2.28e-06	1.93e-09	1.09e-10
4-Methylphenol	108	1.10e-01	6.52e-07	136.82	0.06987	4.60e+00	4.26e-02	8.58e-05	1.02e-06	8.65e-10	4.89e-11
Isophorone	138	3.80e-01	2.88e-06	177.74	0.06078	9.70e+01	7.03e-01	1.42e-03	6.47e-05	5.48e-08	3.10e-09
2,4-Dimethylphenol	122	5.90e-02	3.95e-07	157.28	0.06492	4.90e+00	4.02e-02	8.09e-05	5.42e-07	4.59e-10	2.60e-11
Naphthalene	128	2.60e-04	1.83e-09	180.84	0.06072	9.70e+01	7.58e-01	1.53e-03	4.43e-08	3.75e-11	2.12e-12
2-Methylnaphthalene	142	5.90e-02	4.60e-07	201.3	0.05732	5.60e+01	3.94e-01	7.94e-04	5.47e-06	4.64e-09	2.62e-10
2,4,5-Trichlorophenol	197	1.00e+00	1.08e-05	168.92	0.06056	1.70e-01	8.63e-04	1.74e-06	2.98e-07	2.52e-10	1.42e-11
Dimethylphthalate	194	1.00e-02	1.06e-07	206.72	0.05533	1.40e+00	7.22e-03	1.45e-05	2.24e-08	1.90e-11	1.07e-12
Acenaphthene	154	1.55e-03	1.31e-08	217.8	0.05492	3.60e-01	2.34e-03	4.71e-06	8.86e-10	7.50e-13	4.24e-14
Dibenzofuran	170	2.00e-02	1.87e-07	223.28	0.05390	4.30e-01	2.53e-03	5.10e-06	1.34e-08	1.13e-11	6.41e-13
Diethylphthalate	222	3.50e-03	4.26e-08	247.64	0.05049	5.00e+00	2.25e-02	4.54e-05	2.55e-08	2.16e-11	1.22e-12
Fluorene	116	7.10e-04	4.52e-09	234.3	0.05446	6.20e-01	5.34e-03	1.08e-05	6.93e-10	5.87e-13	3.32e-14
N-Nitrosodiphenylamine	198	3.80e-05	4.13e-10	234.66	0.05213	4.30e+00	2.17e-02	4.37e-05	2.46e-10	2.09e-13	1.18e-14
Pentachlorophenol	266	1.10e-04	1.61e-09	203.96	0.05469	1.50e+00	5.64e-03	1.14e-05	2.61e-10	2.21e-13	1.25e-14
Phenanthrene	178	6.80e-04	6.64e-09	250.8	0.05091	4.30e+00	2.42e-02	4.87e-05	4.30e-09	3.64e-12	2.06e-13
Anthracene	178	1.95e-04	1.91e-09	250.8	0.05091	6.60e-01	3.71e-03	7.47e-06	1.89e-10	1.60e-13	9.07e-15
Di-n-butylphthalate	278	1.00e-05	1.53e-10	329.48	0.04362	9.40e+01	3.38e-01	6.81e-04	1.18e-09	1.00e-12	5.67e-14
Fluoranthene	202	5.00e-06	5.54e-11	283.8	0.04764	3.40e+00	1.68e-02	3.39e-05	2.34e-11	1.98e-14	1.12e-15
Pyrene	202	2.50e-06	2.77e-11	283.8	0.04764	2.30e+00	1.14e-02	2.29e-05	7.92e-12	6.71e-15	3.79e-16
Butylbenzylphthalate	312	8.60e+06	1.47e+02	375.02	0.04077	5.10e+01	1.63e-01	3.29e-04	5.17e+02	4.38e-01	2.47e-02
Benzo(a)anthracene	228	2.20e-08	2.75e-13	320.76	0.04463	2.40e+00	1.05e-02	2.12e-05	6.81e-14	5.77e-17	3.26e-18

Table V-4

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Kapica-Pazmey Surface Soil

COMPOUND	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV (cm <sup>3</sup> /mole)	Di @ 19 C (Cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	Estimated Downwind Concentration	
										100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )
Chrysene	228	6.30e-09	7.88e-14	320.76	0.04463	1.30e+00	5.70e-03	1.15e-05	1.06e-14	8.95e-18	5.06e-19
bis(2-Ethylhexyl)phthalat	391	8.60e+06	1.85e+02	493.16	0.03535	5.40e+02	1.38e+00	2.78e-03	4.74e+03	4.02e+00	2.27e-01
Di-n-octylphthalate	391	8.60e+06	1.85e+02	493.16	0.03535	3.80e+01	9.72e-02	1.96e-04	3.34e+02	2.83e-01	1.60e-02
Benzo(b)fluoranthene	252	5.00e-07	6.92e-12	353.76	0.04236	3.90e+00	1.55e-02	3.12e-05	2.39e-12	2.02e-15	1.14e-16
Benzo(k)fluoranthene	252	5.10e-07	7.05e-12	353.76	0.04236	3.90e+00	1.55e-02	3.12e-05	2.43e-12	2.06e-15	1.17e-16
Benzo(a)pyrene	252	5.60e-09	7.75e-14	353.76	0.04236	1.40e+00	5.56e-03	1.12e-05	9.60e-15	8.13e-18	4.60e-19
Indeno(1,2,3-cd)pyrene	276	1.00e-10	1.51e-15	386.76	0.04039	8.20e-01	2.97e-03	5.99e-06	9.57e-17	8.11e-20	4.58e-21
Dibenz(a,h)anthracene	278	1.00e-10	1.53e-15	390.72	0.04017	2.70e-01	9.71e-04	1.96e-06	3.13e-17	2.66e-20	1.50e-21
Benzo(g,h,i)perylene	276	1.03e-10	1.56e-15	386.76	0.04039	1.10e+00	3.99e-03	8.03e-06	1.32e-16	1.12e-19	6.33e-21
Aldrin	365	6.00e-06	1.20e-10	330.84	0.04304	8.80e-02	2.41e-04	4.86e-07	6.57e-13	5.56e-16	3.15e-17
Endosulfan 1	407	5.50e-06	1.23e-10	310.82	0.04417	4.20e-02	1.03e-04	2.08e-07	2.95e-13	2.50e-16	1.41e-17
4,4-DDD	320	1.89e-06	3.32e-11	385.68	0.04018	1.50e-01	4.69e-04	9.44e-07	3.29e-13	2.79e-16	1.58e-17
TOTAL PCBs	328	7.70e-05	1.39e-09	235.32	0.05074	3.29e+02	1.00e+00	2.02e-03	3.71e-08	3.15e-11	1.78e-12
Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	1.20e-01	1.00e-03	2.01e-06	6.93e-07	5.87e-10	3.32e-11
Propenyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	3.20e+01	2.67e-01	5.37e-04	1.85e-04	1.56e-07	8.85e-09
Ethyl Methyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	3.70e+02	3.08e+00	6.21e-03	2.14e-03	1.81e-06	1.02e-07
Trimethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	2.20e+02	1.83e+00	3.69e-03	3.97e-02	3.36e-05	1.90e-06
Dimethyl ethyl benzenes	106	7.00e+00	4.07e-05	151.8	0.06689	6.00e+01	5.66e-01	1.14e-03	8.12e-04	6.88e-07	3.89e-08
Tetramethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	6.80e+01	5.67e-01	1.14e-03	1.23e-02	1.04e-05	5.88e-07
Cyclic alkanes	98	1.44e+02	7.75e-04	131.34	0.07189	5.20e+01	5.31e-01	1.07e-03	1.56e-02	1.32e-05	7.45e-07
n-chain Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	2.90e+02	3.37e+00	6.79e-03	7.90e-02	6.69e-05	3.78e-06
Branched Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	3.20e+02	3.72e+00	7.50e-03	8.71e-02	7.38e-05	4.17e-06
Methylated Ketones	58	2.70e+02	8.60e-04	66.86	0.10245	1.80e-01	3.10e-03	6.25e-06	1.44e-04	1.22e-07	6.89e-09
Cyclic Acids	122	9.50e+01	6.36e-04	138.34	0.06869	1.90e+01	1.56e-01	3.14e-04	3.58e-03	3.03e-06	1.72e-07
Non-Cyclic Acids	72	3.20e+00	1.26e-05	68.38	0.09820	2.60e+02	3.61e+00	7.27e-03	2.36e-03	2.00e-06	1.13e-07

Table V-4

VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Kapica-Pazmey Surface Soil

This table summarizes the mathematical relationships used to model chemical emission rates from soils and the dispersion of chemical concentrations in air at a distance of 100 meters from the source. The relationships were obtained from the "Superfund Exposure Assessment Manual" (SEAM), 1988. The following defines the column headings: MW, molecular weight; VP, vapor pressure; Csi, saturation vapor concentration; ADV, atomic diffusion volume; Di, diffusion coefficient; Exp. Pnt. Conc., exposure point concentration; Mf, mmoles contaminant per kg soil; Mi, mole fraction (ie. fraction of total moles for each chemical); Ei, estimated emission rate. The following describes the equations and Site specific variables:

$$C_{si} = \frac{VP * MW}{R * T}$$

where:

R = 6.24e+04 (mm Hg-cm<sup>3</sup>/mole-K)  
(T) temperature in degrees K = 293.15

$$E_i = \frac{D_i * C_{si} * A * P_t^{(4/3)} * M_i}{D_{sc}}$$

where:

(A) surface area = 4.70e+07 cm<sup>2</sup>  
(D<sub>sc</sub>) depth of soil cover = 53 cm  
(P<sub>t</sub>) soil porosity = 0.4  
P<sub>t</sub><sup>(4/3)</sup> = 2.95e-01  
^ = exponent

$$D_i = \frac{0.001 * T^{1.75} * ((1/MW) + (1/MW_a))^{(1/2)}}{[(ADV^{(1/3)} + (ADV_a)^{(1/3)})]^2}$$

where:

(MW<sub>a</sub>) molecular wt. of air = 28.8 g/mole  
(ADV<sub>a</sub>) atomic diffusion volume of air = 20.1 cm<sup>3</sup>/mole  
(T) temperature in degrees K = 293.15  
^ = exponent

$$C(x) = \frac{E_i}{(\pi * O_y * O_z * u)} * 0.30$$

where:

C(x) = concentration at distance x  
π = 3.14 at 100 m: 500 m:  
O<sub>y</sub> = lateral dispersion coef., stability class D = 8 35 m  
O<sub>z</sub> = vertical dispersion coef., stability class D = 4.7 19 m  
u = average wind speed (assume 3 m/s)  
0.3 = assume wind blows 30 % of the time towards receptor

Default equation variables were obtained from SEAM. Refer to SEAM for further information.

Table V-5

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Kapica-Pazmey Subsurface Soil

COMPOUND	Chemical Emission (Ei) Calculation						Variables			Estimated Downwind Concentration	
	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV Di @ 19 C (cm <sup>3</sup> /mo (Cm <sup>2</sup> /sec)	Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	100 m (g/m <sup>3</sup> )	500 m (g/m <sup>3</sup> )	
Chloroethane	51	3.80e+03	1.06e-02	62.4	0.10767	8.57e-03	1.68e-04	2.49e-06	9.26e-05	7.84e-084.44e-09	
Acetone	58	2.70e+02	8.60e-04	66.86	0.10245	8.70e+00	1.50e-01	2.23e-03	6.36e-03	5.39e-063.05e-07	
Carbon disulfide	76	3.60e+02	1.50e-03	50.5	0.10977	2.91e-03	3.83e-05	5.68e-07	3.04e-06	2.57e-091.45e-10	
1,1-Dichloroethane	99	1.82e+02	9.89e-04	79.92	0.08853	7.90e-01	7.98e-03	1.18e-04	3.36e-04	2.85e-071.61e-08	
Total-1,2-Dichloroethene	97	2.08e+02	1.11e-03	75.96	0.09059	2.60e+01	2.68e-01	3.98e-03	1.29e-02	1.10e-056.20e-07	
Chloroform	119	1.51e+02	9.86e-04	76.98	0.08818	3.07e-03	2.52e-05	3.74e-07	1.06e-06	8.94e-105.05e-11	
1,2-Dichloroethane	99	6.40e+01	3.48e-04	79.92	0.08853	1.29e-02	1.30e-04	1.93e-06	1.93e-06	1.63e-099.23e-11	
2-Butanone	72	7.75e+01	3.06e-04	87.32	0.08890	9.00e+01	1.25e+00	1.86e-02	1.64e-02	1.39e-057.85e-07	
1,1,1-Trichloroethane	133	1.23e+02	8.98e-04	97.44	0.07917	5.60e-01	4.21e-03	6.25e-05	1.44e-04	1.22e-076.90e-09	
1,2-Dichloropropane	113	4.20e+01	2.61e-04	100.38	0.07942	1.12e-02	9.87e-05	1.46e-06	9.83e-07	8.33e-104.71e-11	
Trichloroethene	131	5.79e+01	4.16e-04	93.48	0.08067	2.50e+02	1.91e+00	2.83e-02	3.09e-02	2.61e-051.48e-06	
Benzene	78	9.52e+01	4.08e-04	110.88	0.07954	2.30e+01	2.95e-01	4.38e-03	4.60e-03	3.90e-062.20e-07	
4-Methyl-2-Pentanone	100	6.00e+00	3.29e-05	128.24	0.07247	4.20e+00	4.20e-02	6.23e-04	4.83e-05	4.09e-082.31e-09	
2-Hexanone	100	2.00e+00	1.10e-05	128.24	0.07247	1.15e-01	1.15e-03	1.70e-05	4.39e-07	3.72e-102.10e-11	
Tetrachloroethene	166	1.78e+01	1.62e-04	111	0.07360	2.40e+02	1.45e+00	2.15e-02	8.31e-03	7.04e-063.98e-07	
Toluene	92	2.81e+01	1.42e-04	131.34	0.07242	1.40e+03	1.52e+01	2.26e-01	7.53e-02	6.38e-053.61e-06	
Chlorobenzene	113	1.17e+01	7.26e-05	128.4	0.07149	2.70e+01	2.39e-01	3.55e-03	5.97e-04	5.05e-072.86e-08	
Ethylbenzene	106	7.00e+00	4.07e-05	151.8	0.06689	5.70e+02	5.38e+00	7.98e-02	7.05e-03	5.97e-063.38e-07	
Styrene	104	5.00e+00	2.85e-05	147.84	0.06781	2.60e+02	2.50e+00	3.71e-02	2.33e-03	1.97e-061.12e-07	
Total Xylenes	106	1.00e+01	5.82e-05	151.8	0.06689	1.70e+03	1.60e+01	2.38e-01	3.00e-02	2.54e-051.44e-06	
Phenol	94	3.41e-01	1.76e-06	116.36	0.07610	9.60e+00	1.02e-01	1.52e-03	6.58e-06	5.58e-093.15e-10	
1,2-Dichlorobenzene	147	1.00e+00	8.07e-06	145.92	0.06600	2.60e-01	1.77e-03	2.62e-05	4.53e-07	3.84e-102.17e-11	
2-Methylphenol	108	2.40e-01	1.42e-06	136.82	0.06987	4.10e+00	3.80e-02	5.63e-04	1.82e-06	1.54e-098.70e-11	
4-Methylphenol	108	1.10e-01	6.52e-07	136.82	0.06987	2.40e+00	2.22e-02	3.30e-04	4.87e-07	4.13e-102.33e-11	
Isophorone	138	3.80e-01	2.88e-06	177.74	0.06078	6.50e+01	4.71e-01	6.99e-03	3.97e-05	3.36e-081.90e-09	
2,4-Dimethylphenol	122	5.90e-02	3.95e-07	157.28	0.06492	2.20e+00	1.80e-02	2.68e-04	2.23e-07	1.89e-101.07e-11	
Benzoic acid	122	9.52e+01	6.37e-04	138.34	0.06869	7.00e-01	5.74e-03	8.51e-05	1.21e-04	1.02e-075.79e-09	
Naphthalene	128	2.60e-04	1.83e-09	180.84	0.06072	2.30e+01	1.80e-01	2.67e-03	9.59e-09	8.13e-124.59e-13	
2-Methylnaphthalene	142	5.90e-02	4.60e-07	201.3	0.05732	1.60e+01	1.13e-01	1.67e-03	1.43e-06	1.21e-096.85e-11	
Dimethylphthalate	194	1.00e-02	1.06e-07	206.72	0.05533	6.50e+00	3.35e-02	4.97e-04	9.50e-08	8.05e-114.55e-12	
Acenaphthene	154	1.55e-03	1.31e-08	217.8	0.05492	7.10e-01	4.61e-03	6.84e-05	1.60e-09	1.35e-127.65e-14	
4-Nitrophenol	139	5.90e-02	4.50e-07	131.03	0.06951	4.60e+00	3.31e-02	4.91e-04	4.98e-07	4.22e-102.39e-11	
Dibenzofuran	170	2.00e-02	1.87e-07	223.28	0.05390	6.40e-01	3.76e-03	5.59e-05	1.82e-08	1.54e-118.73e-13	
2,4-Dinitrotoluene	182	5.10e-03	5.09e-08	160.68	0.06225	8.40e-01	4.62e-03	6.85e-05	7.05e-09	5.97e-123.37e-13	
Diethylphthalate	222	3.50e-03	4.26e-08	247.64	0.05049	1.30e+00	5.86e-03	8.69e-05	6.07e-09	5.14e-124.91e-13	
Fluorene	116	7.10e-04	4.52e-09	234.3	0.05446	7.60e-01	6.55e-03	9.72e-05	7.77e-10	6.58e-133.72e-14	
Pentachlorophenol	266	1.10e-04	1.61e-09	203.96	0.05469	1.60e+01	6.02e-02	8.93e-04	2.54e-09	2.15e-121.22e-13	
Phenanthrene	178	6.80e-04	6.64e-09	250.8	0.05091	4.80e+00	2.70e-02	4.00e-04	4.39e-09	3.72e-122.10e-13	
Anthracene	178	1.95e-04	1.91e-09	250.8	0.05091	8.90e-01	5.00e-03	7.42e-05	2.33e-10	1.98e-131.12e-14	

Table V-5

## VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Kapica-Pazmey Subsurface Soil

COMPOUND	Chemical Emission (Ei) Calculation					Variables Exp. Pnt. Conc. (mg/kg)	Mf mM/kg soil	Mi (mole/mole)	Ei (g/sec)	Estimated Downwind Concentration 100 m. 500 m	
	MW (g/mole)	VP (mm Hg)	CSI (g/cm <sup>3</sup> )	ADV Di @ 19 C (cm <sup>3</sup> /mo (Cm <sup>2</sup> /sec)						(g/m <sup>3</sup> )	(g/m <sup>3</sup> )
Di-n-butylphthalate	278	1.00e-05	1.53e-10	329.48	0.04362	1.90e+01	6.83e-02	1.01e-03	2.19e-10	1.85e-13	1.05e-14
Fluoranthene	202	5.00e-06	5.54e-11	283.8	0.04764	6.00e+00	2.97e-02	4.41e-04	3.78e-11	3.20e-14	1.81e-15
Pyrene	202	2.50e-06	2.77e-11	283.8	0.04764	4.20e+00	2.08e-02	3.09e-04	1.32e-11	1.12e-14	3.3e-16
Butylbenzylphthalate	312	8.60e+06	1.47e+02	375.02	0.04077	2.00e+01	6.41e-02	9.51e-04	1.85e+02	1.57e-01	8.7e-03
Benzo(a)anthracene	228	2.20e-08	2.75e-13	320.76	0.04463	2.10e+00	9.21e-03	1.37e-04	5.45e-14	4.62e-17	2.61e-18
Chrysene	228	6.30e-09	7.88e-14	320.76	0.04463	1.50e+00	6.58e-03	9.76e-05	1.11e-14	9.44e-18	3.4e-19
bis(2-Ethylhexyl)phthalat	391	8.60e+06	1.85e+02	493.16	0.03535	1.10e+02	2.81e-01	4.18e-03	8.84e+02	7.48e-01	2.3e-02
Di-n-octylphthalate	391	8.60e+06	1.85e+02	493.16	0.03535	3.30e+00	8.44e-03	1.25e-04	2.65e+01	2.25e-02	1.27e-03
Benzo(b)fluoranthene	252	5.00e-07	6.92e-12	353.76	0.04236	2.20e+00	8.73e-03	1.30e-04	1.23e-12	1.04e-15	9.0e-17
Benzo(k)fluoranthene	252	5.10e-07	7.05e-12	353.76	0.04236	2.20e+00	8.73e-03	1.30e-04	1.26e-12	1.06e-15	1.0e-17
Benzo(a)pyrene	252	5.60e-09	7.75e-14	353.76	0.04236	6.10e-01	2.42e-03	3.59e-05	3.82e-15	3.24e-18	1.83e-19
Benzo(g,h,i)perylene	276	1.03e-10	1.56e-15	386.76	0.04039	2.60e+01	9.42e-04	1.40e-05	2.86e-17	2.42e-20	1.37e-21
TOTAL PCBs	328	7.70e-05	1.39e-09	235.32	0.05074	5.85e+01	1.78e-01	2.65e-03	6.04e-09	5.12e-12	2.89e-13
Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	1.30e+02	1.08e+00	1.61e-02	6.86e-04	5.81e-07	2.9e-08
Ethyl Methyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	8.80e+02	7.33e+00	1.09e-01	4.65e-03	3.94e-06	2.3e-07
Methyl Propyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	9.80e+01	8.17e-01	1.21e-02	5.17e-04	4.38e-07	2.48e-08
Methyl Ethenyl Benzenes	120	3.20e+00	2.11e-05	172.26	0.06244	4.40e+01	3.67e-01	5.44e-03	2.32e-04	1.97e-07	1.1e-08
Trimethyl Benzenes	120	1.00e+02	6.59e-04	172.26	0.06244	5.20e+02	4.33e+00	6.43e-02	8.58e-02	7.27e-05	4.1e-06
Dimethyl ethyl benzenes	106	7.00e+00	4.07e-05	151.8	0.06689	7.90e+01	7.45e-01	1.11e-02	9.77e-04	8.28e-07	4.68e-08
Cyclic alkanes	98	1.44e+02	7.75e-04	131.34	0.07189	4.10e-02	4.18e-04	6.21e-06	1.12e-05	9.50e-09	3.7e-10
Halogenated Alkanes	133	1.23e+02	8.98e-04	97.44	0.07917	2.10e-01	1.58e-03	2.34e-05	5.40e-05	4.58e-08	2.59e-09
n-chain Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	2.60e+02	3.02e+00	4.49e-02	6.47e-02	5.48e-05	3.10e-06
Branched Alkanes	86	1.20e+02	5.66e-04	110.88	0.07853	1.10e+02	1.28e+00	1.90e-02	2.74e-02	2.32e-05	1.3e-06
Branched Alkenes/Alkynes	86	1.20e+02	5.66e-04	110.88	0.07853	2.10e-01	2.44e-03	3.62e-05	5.23e-05	4.43e-08	2.50e-09
Methylated Ketones	58	2.70e+02	8.60e-04	66.86	0.10245	9.60e-03	1.66e-04	2.46e-06	7.02e-06	5.94e-09	3.6e-10
Simple Ketones	72	7.75e+01	3.06e-04	87.32	0.08890	8.10e-01	1.13e-02	1.67e-04	1.47e-04	1.25e-07	7.06e-09
Simple Alcohols	74	4.40e+00	1.79e-05	91.28	0.08694	2.40e-02	3.24e-04	4.81e-06	2.43e-07	2.05e-10	1.6e-11
Cyclic Alcohols	108	1.00e+00	5.93e-06	136.82	0.06987	1.50e+00	1.39e-02	2.06e-04	2.77e-06	2.35e-09	1.33e-10
Non-Cyclic Acids	72	3.20e+00	1.26e-05	68.38	0.09820	1.30e+02	1.81e+00	2.68e-02	1.08e-03	9.14e-07	5.17e-08

Table V-5

VOC EMISSION ESTIMATE CALCULATIONS

American Chemical Services Remedial Investigation  
Griffith Indiana

Source Area: Kapica-Pazmey Subsurface Soil

This table summarizes the mathematical relationships used to model chemical emission rates from soils and the dispersion of chemical concentrations in air at a distance of 100 meters from the source. The relationships were obtained from the "Superfund Exposure Assessment Manual" (SEAM), 1988. The following defines the column headings: MW, molecular weight; VP, vapor pressure; Csi, saturation vapor concentration; ADV, atomic diffusion volume; Di, diffusion coefficient; Exp. Pnt. Conc., exposure point concentration; Mf, mmoles contaminant per kg soil; Mi, mole fraction (ie. fraction of total moles for each chemical); Ei, estimated emission rate. The following describes the equations and Site specific variables:

$$C_{si} = \frac{VP * MW}{R * T}$$

where:

R = 6.24e+04 (mm Hg-cm<sup>3</sup>/mole-K)  
(T) temperature in degrees K = 293.15

$$E_i = \frac{D_i * C_{si} * A * Pt^{(4/3)} * M_i}{D_{sc}}$$

where:

(A) surface area = 47,000,000 cm<sup>2</sup>  
(Dcs) depth of soil cover 427 cm  
(Pt) soil porosity = 0.4  
Pt<sup>(4/3)</sup> = 2.95e-01  
^ = exponent

$$D_i = \frac{0.001 * T^{1.75} * ((1/MW) + (1/MW_a))^{(1/2)}}{[(ADV^{(1/3)} + (ADV_a^{(1/3)}))]^2}$$

where:

(MWa) molecular wt. of air = 28.8 g/mole  
(ADVa) atomic diffusion volume of air = 20.1 cm<sup>3</sup>/mole  
(T) temperature in degrees K = 293.15  
^ = exponent

$$C(x) = \frac{E_i}{(\pi * O_y * O_z * u)} * 0.30$$

where:

C(x) = concentration at distance x  
pi = 3.14  
Oy = lateral dispersion coef., stability class D = 8 at 100 m: 500 m:  
Oz = vertical dispersion coef., stability class D = 4.7 35 m 19 m  
u = average wind speed (assume 3 m/s)  
0.3 = assume wind blows 30 % of the time towards receptor

Default equation variables were obtained from SEAM. Refer to SEAM for further information.

Table V-6

## SUMMARY OF CHEMICAL EXPOSURE POINT CONCENTRATIONS

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Chemical of Potential Concern	----- 100 Meters -----						Maximum Estimated Conc.	Maximum Estimated Conc.
	Onsite Containment Area	Still Bottoms Treatment Lagoon	Offsite Containment Area	Kapica Pazmey Surface	Kapica Pazmey Sub-Surface	Maximum Estimated Conc.		
	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(mg/m <sup>3</sup> )	
<b>VOLATILES</b>								
Vinyl chloride			6.78e-07			6.78e-07	6.78e-04	
Chloroethane	4.17e-02		6.74e-07		7.84e-08	4.17e-02	4.17e+01	
Methylene chloride		5.21e-05	6.36e-06	1.80e-07		5.21e-05	5.21e-02	
Acetone	6.19e-07	1.24e-06	3.89e-04	6.57e-07	5.39e-06	3.89e-04	3.89e-01	
Carbon disulfide					2.57e-09	2.57e-09	2.57e-06	
1,1-Dichloroethene			1.75e-05			1.75e-05	1.75e-02	
1,1-Dichloroethane	1.22e-09	1.32e-06	6.51e-06	5.92e-08	2.85e-07	6.51e-06	6.51e-03	
1,2-Dichloroethene (cis)	6.24e-07	2.25e-05	5.28e-07	3.51e-06	1.10e-05	2.25e-05	2.25e-02	
Chloroform	1.25e-07	1.04e-04	3.07e-05	3.26e-09	8.94e-10	1.04e-04	1.04e-01	
1,2-Dichloroethane	3.50e-08	8.45e-07	2.05e-06		1.63e-09	2.05e-06	2.05e-03	
2-Butanone	8.80e-09	1.36e-05	5.62e-04		1.39e-05	5.62e-04	5.62e-01	
1,1,1-Trichloroethane	8.13e-05	7.62e-04	1.20e-03	2.15e-09	1.22e-07	1.20e-03	1.20e+00	
Carbon tetrachloride		9.57e-05				9.57e-05	9.57e-02	
1,2-Dichloropropane	1.59e-08	2.74e-07	1.87e-07	1.55e-09	8.33e-10	2.74e-07	2.74e-04	
Trichloroethene	3.62e-07	2.96e-05	7.31e-05	1.94e-05	2.61e-05	7.31e-05	7.31e-02	
1,1,2-Trichloroethane	5.56e-10	7.17e-08	7.83e-07			7.83e-07	7.83e-04	
Benzene	1.74e-05	4.80e-06	9.36e-06	5.93e-07	3.90e-06	1.74e-05	1.74e-02	
4-Methyl-2-pentanone	1.45e-09	2.43e-06	2.19e-05	2.87e-06	4.09e-08	2.19e-05	2.19e-02	
2-Hexanone			5.61e-09		3.72e-10	5.61e-09	5.61e-06	
Tetrachloroethene	4.92e-05	7.81e-06	4.97e-05	2.53e-05	7.04e-06	4.97e-05	4.97e-02	
1,1,2,2-Tetrachloroethane	8.99e-09		2.67e-12			8.99e-09	8.99e-06	
Toluene	1.03e-03	1.74e-04	2.18e-04	9.46e-04	6.38e-05	1.03e-03	1.03e+00	
Chlorobenzene	2.34e-10	6.24e-12	6.89e-07	1.27e-07	5.05e-07	6.89e-07	6.89e-04	
Ethylbenzene	2.00e-05	1.47e-05	8.88e-06	4.93e-05	5.97e-06	4.93e-05	4.93e-02	
Styrene	1.34e-08	2.02e-07	8.66e-08	1.91e-07	1.97e-06	1.97e-06	1.97e-03	
Xylenes (mixed)	1.06e-04	2.34e-05	5.51e-05	3.77e-04	2.54e-05	3.77e-04	3.77e-01	
<b>SEMIVOLATILES</b>								
Phenol	7.13e-11	1.05e-08	1.10e-08	1.78e-08	5.58e-09	1.78e-08	1.78e-05	
bis(2-Chloroethyl) ether		2.05e-08	8.24e-09			2.05e-08	2.05e-05	
2-Chlorophenol		1.98e-12				1.98e-12	1.98e-09	
1,3-Dichlorobenzene	2.20e-10	2.16e-10				2.20e-10	2.20e-07	
1,4-Dichlorobenzene	2.79e-10	6.95e-10	3.54e-10			6.95e-10	6.95e-07	
Benzyl Alcohol		1.71e-08	1.86e-07			1.86e-07	1.86e-04	
1,2-Dichlorobenzene	4.16e-09	1.72e-08	6.53e-09	9.53e-10	3.84e-10	1.72e-08	1.72e-05	
2-Methylphenol	1.69e-10	9.38e-10	9.38e-10	1.93e-09	1.54e-09	1.93e-09	1.93e-06	
4-Methylphenol	1.23e-10	1.23e-09	1.33e-09	8.65e-10	4.13e-10	1.33e-09	1.33e-06	
Isophorone		2.24e-07	6.85e-08	5.48e-08	3.36e-08	2.24e-07	2.24e-04	
2,4-Dimethylphenol	5.82e-11	2.03e-11	3.67e-10	4.59e-10	1.89e-10	4.59e-10	4.59e-07	
Benzoic Acid	2.04e-09	7.93e-07	6.31e-05		1.02e-07	6.31e-05	6.31e-02	
2,4-Dichlorophenol	5.45e-12	2.37e-11	6.26e-13			2.37e-11	2.37e-08	
1,2,4-Trichlorobenzene		9.61e-11	5.08e-10			5.08e-10	5.08e-07	
Naphthalene	9.05e-12	4.41e-11	3.12e-11	3.75e-11	8.13e-12	4.41e-11	4.41e-08	
Hexachlorobutadiene		1.71e-08	1.42e-08			1.71e-08	1.71e-05	
4-Chloro-3-methylphenol		4.50e-12				4.50e-12	4.50e-09	
2-Methylnaphthalene	1.18e-09	4.03e-09	2.76e-09	4.64e-09	1.21e-09	4.64e-09	4.64e-06	
2,4,6-Trichlorophenol		9.39e-13				9.39e-13	9.39e-10	
2,4,5-Trichlorophenol	8.23e-11	2.17e-11		2.52e-10		2.52e-10	2.52e-07	
2-Chloronaphthalene		6.83e-12				6.83e-12	6.83e-09	
Dimethylphthalate	1.23e-11	6.60e-10	2.38e-10	1.90e-11	8.05e-11	6.60e-10	6.60e-07	
Acenaphthylene	9.19e-12	1.98e-11	2.52e-12			1.98e-11	1.98e-08	
2,6-Dinitrotoluene			6.92e-13			6.92e-13	6.92e-10	
Acenaphthene	1.12e-12	7.40e-13	1.26e-12	7.50e-13	1.35e-12	1.35e-12	1.35e-09	
4-Nitrophenol		2.32e-11	1.05e-11		4.22e-10	4.22e-10	4.22e-07	
Dibenzofuran		1.37e-12	3.69e-12	1.13e-11	1.54e-11	1.54e-11	1.54e-08	
2,4-Dinitrotoluene					5.97e-12	5.97e-12	5.97e-09	

Table V-6

## SUMMARY OF CHEMICAL EXPOSURE POINT CONCENTRATIONS

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Chemical of Potential Concern	----- 100 Meters -----		Offsite Containment Area	Kapica Pazmey Surface	Kapica Pazmey Sub-Surface	Maximum Estimated Conc.	Maximum Estimated Conc.
	Onsite Containment Area	Still Bottoms Treatment Lagoon					
	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(mg/m <sup>3</sup> )
Diethylphthalate	5.29e-14	6.59e-11	4.08e-11	2.16e-11	5.14e-12	6.59e-11	6.59e-08
Fluorene	5.71e-13	7.31e-13	9.88e-13	5.87e-13	6.58e-13	9.88e-13	9.88e-10
N-nitrosodiphenylamine		9.60e-14	8.65e-14	2.09e-13		2.09e-13	2.09e-10
4-Bromophenyl-phenylether		3.38e-12				3.38e-12	3.38e-09
Hexachlorobenzene		1.55e-15	9.17e-16			1.55e-15	1.55e-12
Pentachlorophenol	6.13e-15	1.44e-12	8.92e-13	2.21e-13	2.15e-12	2.15e-12	2.15e-09
Phenanthrene	9.40e-13	1.29e-12	1.23e-12	3.64e-12	3.72e-12	3.72e-12	3.72e-09
Anthracene	5.94e-15	3.53e-14	5.62e-15	1.60e-13	1.98e-13	1.98e-13	1.98e-10
Di-n-butylphthalate	3.23e-14	1.12e-12	1.22e-12	1.00e-12	1.85e-13	1.22e-12	1.22e-09
Fluoranthene	1.20e-15	5.42e-16	3.30e-15	1.98e-14	3.20e-14	3.20e-14	3.20e-11
Pyrene	7.08e-16	7.53e-16	2.16e-15	6.71e-15	1.12e-14	1.12e-14	1.12e-11
Butylbenzylphthalate	5.07e-03	1.25e+00	4.62e-01	4.38e-01	1.57e-01	1.25e+00	1.25e+03
Benzo(a)anthracene	1.06e-18	1.18e-18	1.29e-17	5.77e-17	4.62e-17	5.77e-17	5.77e-14
Chrysene	1.50e-19	3.10e-19	4.06e-18	8.95e-18	9.44e-18	9.44e-18	9.44e-15
bis(2-ethylhexyl)phthalate	2.71e-01	2.95e+00	3.51e+00	4.02e+00	7.48e-01	4.02e+00	4.02e+03
Di-n-octyl Phthalate		2.21e-02	3.51e-02	2.83e-01	2.25e-02	2.83e-01	2.83e+02
Benzo(b)fluoranthene		2.52e-17	2.62e-16	2.02e-15	1.04e-15	2.02e-15	2.02e-12
Benzo(k)fluoranthene		2.57e-17	2.67e-16	2.06e-15	1.06e-15	2.06e-15	2.06e-12
Benzo(a)pyrene		1.90e-19	4.38e-19	8.13e-18	3.24e-18	8.13e-18	8.13e-15
Ideno(1,2,3-cd)pyrene			2.72e-21	8.11e-20		8.11e-20	8.11e-17
Dibenz(a,h)anthracene			6.29e-22	2.66e-20		2.66e-20	2.66e-17
Benzo(g,h,i)perylene			2.14e-21	1.12e-19	2.42e-20	1.12e-19	1.12e-16
PESTICIDE/PCB							
alpha-BHC			2.68e-16			2.68e-16	2.68e-13
beta-BHC			8.57e-18			8.57e-18	8.57e-15
gamma-BHC (Lindane)		4.67e-06				4.67e-06	4.67e-03
Aldrin			1.91e-16	5.56e-16		5.56e-16	5.56e-13
Heptachlor epoxide			6.94e-17			6.94e-17	6.94e-14
Endosulfan I	9.21e-18	1.09e-15		2.50e-16		1.09e-15	1.09e-12
4,4'-DDE			1.05e-16			1.05e-16	1.05e-13
4,4'-DDD			8.48e-17	2.79e-16		2.79e-16	2.79e-13
4,4'-DDT	2.35e-17	2.42e-14	1.70e-16			2.42e-14	2.42e-11
Endrin ketone		7.36e-18				7.36e-18	7.36e-15
Total - PCBs	2.01e-13	2.30e-12	1.45e-12	3.15e-11	5.12e-12	3.15e-11	3.15e-08
TIC GROUPS							
Propyl Benzenes	2.54e-08	2.83e-07	8.56e-08	5.87e-10	5.81e-07	5.81e-07	5.81e-04
Propenyl Benzenes		4.99e-08	1.98e-08	1.56e-07		1.56e-07	1.56e-04
Ethyl Methyl Benzenes	1.40e-07	1.42e-06	9.72e-07	1.81e-06	3.94e-06	3.94e-06	3.94e-03
Diethyl Benzenes	8.35e-08	8.90e-07	8.49e-07			8.90e-07	8.90e-04
Methyl Propyl Benzenes	1.78e-09	8.19e-07	1.55e-07		4.38e-07	8.19e-07	8.19e-04
Methyl Ethenyl Benzenes	1.78e-09				1.97e-07	1.97e-07	1.97e-04
Methyl Phenyl Benzenes		1.82e-12				1.82e-12	1.82e-09
Trimethyl Benzenes	1.55e-05	4.19e-05	5.04e-05	3.36e-05	7.27e-05	7.27e-05	7.27e-02
Dimethyl ethyl benzenes	5.96e-07	3.32e-06	6.56e-07	6.88e-07	8.28e-07	3.32e-06	3.32e-03
Tetramethyl Benzenes	4.37e-10	3.03e-05	1.49e-06	1.04e-05		3.03e-05	3.03e-02
Oxygenated Benzenes	1.17e-05	2.64e-06	2.05e-05			2.05e-05	2.05e-02
Nitrogenated Benzenes		1.00e-08	8.76e-09			1.00e-08	1.00e-05
Cyclic alkanes	3.49e-06	2.24e-04	8.45e-07	1.32e-05	9.50e-09	2.24e-04	2.24e-01
Cyclic Alkenes	2.44e-05	4.63e-05	4.01e-06			4.63e-05	4.63e-02
Halogenated Alkanes	1.36e-07	1.74e-04			4.58e-08	1.74e-04	1.74e-01
n-chain Alkanes	1.92e-05	8.08e-04	1.01e-05	6.69e-05	5.48e-05	8.08e-04	8.08e-01
Branched Alkanes	1.08e-05	2.07e-04	1.79e-05	7.38e-05	2.32e-05	2.07e-04	2.07e-01
Branched Alkenes/Alkynes	3.66e-05	9.13e-05	1.09e-06		4.43e-08	9.13e-05	9.13e-02
Ethers			2.91e-06			2.91e-06	2.91e-03
Methylated Naphthalenes	1.00e-12	3.98e-12	1.13e-11			1.13e-11	1.13e-08

Table V-6

## SUMMARY OF CHEMICAL EXPOSURE POINT CONCENTRATIONS

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Chemical of Potential Concern	----- 100 Meters -----					Maximum Estimated Conc. (g/m <sup>3</sup> )	Maximum Estimated Conc. (mg/m <sup>3</sup> )
	Onsite Containment Area (g/m <sup>3</sup> )	Still Bottoms Treatment Lagoon (g/m <sup>3</sup> )	Offsite Containment Area (g/m <sup>3</sup> )	Kapica Pazmey Surface (g/m <sup>3</sup> )	Kapica Pazmey Sub-Surface (g/m <sup>3</sup> )		
Phthalates		2.77e-12	1.27e-11			1.27e-11	1.27e-08
Methylated Phenols	1.17e-10	4.50e-11	7.46e-10			7.46e-10	7.46e-07
Methylated Ketones		1.65e-07	2.28e-06	1.22e-07	5.94e-09	2.28e-06	2.28e-03
Simple Ketones		1.98e-08	5.17e-09		1.25e-07	1.25e-07	1.25e-04
Cyclic Ketones	9.12e-11	1.38e-08	1.52e-09			1.38e-08	1.38e-05
Diols		6.08e-11	1.17e-08			1.17e-08	1.17e-05
Simple Alcohols	5.60e-12	7.84e-08	1.51e-07		2.05e-10	1.51e-07	1.51e-04
Cyclic Alcohols		3.91e-09	7.49e-10		2.35e-09	3.91e-09	3.91e-06
Oxygenated Alcohols		4.32e-08	8.20e-08			8.20e-08	8.20e-05
Cyclic Acids			4.19e-07	3.03e-06		3.03e-06	3.03e-03
Non-Cyclic Acids	4.40e-07	3.63e-07	1.63e-05	2.00e-06	9.14e-07	1.63e-05	1.63e-02
Amines	7.65e-11	3.69e-11	3.09e-11			7.65e-11	7.65e-08
PCBs	1.87e-13					1.87e-13	1.87e-10
Furans	1.04e-07	1.91e-08	2.98e-09			1.04e-07	1.04e-04

This table contains values calculated in tables V-1 through V-5. Since a receptor at a given point would be exposed to varying amounts from each area, a single value is selected to represent exposure. The maximum emission estimate from the five source areas is selected and converted from g/m<sup>3</sup> to mg/m<sup>3</sup>.

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Table V-6

## SUMMARY OF CHEMICAL EXPOSURE POINT CONCENTRATIONS

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Chemical of Potential Concern	----- 500 Meters -----						
	Onsite Containment Area	Still Bottoms Treatment Lagoon	Offsite Containment Area	Kapica Pazmey Surface	Kapica Pazmey Sub-Surface	Maximum Estimated Conc.	Maximum Estimated Conc.
	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(mg/m <sup>3</sup> )
<b>VOLATILES</b>							
Vinyl chloride			3.83e-08			3.83e-08	3.83e-05
Chloroethane	2.36e-03		3.81e-08		4.44e-09	2.36e-03	2.36e+00
Methylene chloride		2.94e-06	3.60e-07	1.02e-08		2.94e-06	2.94e-03
Acetone	3.50e-08	7.00e-08	2.20e-05	3.71e-08	3.05e-07	2.20e-05	2.20e-02
Carbon disulfide					1.45e-10	1.45e-10	1.45e-07
1,1-Dichloroethene			9.88e-07			9.88e-07	9.88e-04
1,1-Dichloroethane	6.89e-11	7.47e-08	3.68e-07	3.34e-09	1.61e-08	3.68e-07	3.68e-04
1,2-Dichloroethene (cis)	3.53e-08	1.27e-06	2.99e-08	1.98e-07	6.20e-07	1.27e-06	1.27e-03
Chloroform	7.09e-09	5.89e-06	1.74e-06	1.84e-10	5.05e-11	5.89e-06	5.89e-03
1,2-Dichloroethane	1.98e-09	4.78e-08	1.16e-07		9.23e-11	1.16e-07	1.16e-04
2-Butanone	4.97e-10	7.70e-07	3.18e-05		7.85e-07	3.18e-05	3.18e-02
1,1,1-Trichloroethane	4.59e-06	4.31e-05	6.81e-05	1.21e-10	6.90e-09	6.81e-05	6.81e-02
Carbon tetrachloride		5.41e-06				5.41e-06	5.41e-03
1,2-Dichloropropane	9.02e-10	1.55e-08	1.06e-08	8.77e-11	4.71e-11	1.55e-08	1.55e-05
Trichloroethene	2.05e-08	1.67e-06	4.14e-06	1.10e-06	1.48e-06	4.14e-06	4.14e-03
1,1,2-Trichloroethane	3.14e-11	4.06e-09	4.43e-08			4.43e-08	4.43e-05
Benzene	9.85e-07	2.71e-07	5.29e-07	3.35e-08	2.20e-07	9.85e-07	9.85e-04
4-Methyl-2-pentanone	8.19e-11	1.37e-07	1.24e-06	1.62e-07	2.31e-09	1.24e-06	1.24e-03
2-Hexanone			3.17e-10		2.10e-11	3.17e-10	3.17e-07
Tetrachloroethene	2.78e-06	4.42e-07	2.81e-06	1.43e-06	3.98e-07	2.81e-06	2.81e-03
1,1,2,2-Tetrachloroethane	5.08e-10		1.51e-13			5.08e-10	5.08e-07
Toluene	5.81e-05	9.86e-06	1.23e-05	5.35e-05	3.61e-06	5.81e-05	5.81e-02
Chlorobenzene	1.32e-11	3.53e-13	3.90e-08	7.18e-09	2.86e-08	3.90e-08	3.90e-05
Ethylbenzene	1.13e-06	8.29e-07	5.02e-07	2.79e-06	3.38e-07	2.79e-06	2.79e-03
Styrene	7.57e-10	1.14e-08	4.90e-09	1.08e-08	1.12e-07	1.12e-07	1.12e-04
Xylenes (mixed)	6.02e-06	1.33e-06	3.12e-06	2.13e-05	1.44e-06	2.13e-05	2.13e-02
<b>SEMIVOLATILES</b>							
Phenol	4.03e-12	5.94e-10	6.19e-10	1.01e-09	3.15e-10	1.01e-09	1.01e-06
bis(2-Chloroethyl) ether		1.16e-09	4.66e-10			1.16e-09	1.16e-06
2-Chlorophenol		1.12e-13				1.12e-13	1.12e-10
1,3-Dichlorobenzene	1.25e-11	1.22e-11				1.25e-11	1.25e-08
1,4-Dichlorobenzene	1.58e-11	3.93e-11	2.00e-11			3.93e-11	3.93e-08
Benzyl Alcohol		9.65e-10	1.05e-08			1.05e-08	1.05e-05
1,2-Dichlorobenzene	2.35e-10	9.74e-10	3.69e-10	5.39e-11	2.17e-11	9.74e-10	9.74e-07
2-Methylphenol	9.57e-12	5.30e-11	5.30e-11	1.09e-10	8.70e-11	1.09e-10	1.09e-07
4-Methylphenol	6.93e-12	6.97e-11	7.52e-11	4.89e-11	2.33e-11	7.52e-11	7.52e-08
Isophorone		1.27e-08	3.87e-09	3.10e-09	1.90e-09	1.27e-08	1.27e-05
2,4-Dimethylphenol	3.29e-12	1.15e-12	2.08e-11	2.60e-11	1.07e-11	2.60e-11	2.60e-08
Benzoic Acid	1.15e-10	4.48e-08	3.57e-06		5.79e-09	3.57e-06	3.57e-03
2,4-Dichlorophenol	3.08e-13	1.34e-12	3.54e-14			1.34e-12	1.34e-09
1,2,4-Trichlorobenzene		5.44e-12	2.87e-11			2.87e-11	2.87e-08
Naphthalene	5.11e-13	2.50e-12	1.77e-12	2.12e-12	4.59e-13	2.50e-12	2.50e-09
Hexachlorobutadiene		9.70e-10	8.04e-10			9.70e-10	9.70e-07
4-Chloro-3-methylphenol		2.54e-13				2.54e-13	2.54e-10
2-Methylnaphthalene	6.70e-11	2.28e-10	1.56e-10	2.62e-10	6.85e-11	2.62e-10	2.62e-07
2,4,6-Trichlorophenol		5.31e-14				5.31e-14	5.31e-11
2,4,5-Trichlorophenol	4.65e-12	1.23e-12		1.42e-11		1.42e-11	1.42e-08
2-Chloronaphthalene		3.86e-13				3.86e-13	3.86e-10
Dimethylphthalate	6.97e-13	3.73e-11	1.34e-11	1.07e-12	4.55e-12	3.73e-11	3.73e-08
Acenaphthylene	5.20e-13	1.12e-12	1.43e-13			1.12e-12	1.12e-09
2,6-Dinitrotoluene			3.91e-14			3.91e-14	3.91e-11
Acenaphthene	6.31e-14	4.19e-14	7.14e-14	4.24e-14	7.65e-14	7.65e-14	7.65e-11
4-Nitrophenol		1.31e-12	5.95e-13			2.39e-11	2.39e-08
Dibenzofuran		7.76e-14	2.09e-13	6.41e-13	8.73e-13	8.73e-13	8.73e-10
2,4-Dinitrotoluene					3.37e-13	3.37e-13	3.37e-10

Table V-6

## SUMMARY OF CHEMICAL EXPOSURE POINT CONCENTRATIONS

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Chemical of Potential Concern	----- 500 Meters -----						Maximum Estimated Conc. (g/m <sup>3</sup> )	Maximum Estimated Conc. (mg/m <sup>3</sup> )
	Onsite Containment Area (g/m <sup>3</sup> )	Still Bottoms Treatment Lagoon (g/m <sup>3</sup> )	Offsite Containment Area (g/m <sup>3</sup> )	Kapica Pazmey Surface (g/m <sup>3</sup> )	Kapica Pazmey Sub-Surface (g/m <sup>3</sup> )			
Diethylphthalate	2.99e-15	3.72e-12	2.31e-12	1.22e-12	2.91e-13	3.72e-12	3.72e-09	
Fluorene	3.23e-14	4.13e-14	5.59e-14	3.32e-14	3.72e-14	5.59e-14	5.59e-11	
N-nitrosodiphenylamine		5.43e-15	4.89e-15	1.18e-14		1.18e-14	1.18e-11	
4-Bromophenyl-phenylether		1.91e-13				1.91e-13	1.91e-10	
Hexachlorobenzene		8.74e-17	5.18e-17			8.74e-17	8.74e-14	
Pentachlorophenol	3.46e-16	8.11e-14	5.05e-14	1.25e-14	1.22e-13	1.22e-13	1.22e-10	
Phenanthrene	5.31e-14	7.30e-14	6.94e-14	2.06e-13	2.10e-13	2.10e-13	2.10e-10	
Anthracene	3.36e-16	1.99e-15	3.18e-16	9.07e-15	1.12e-14	1.12e-14	1.12e-11	
Di-n-butylphthalate	1.82e-15	6.34e-14	6.91e-14	5.67e-14	1.05e-14	6.91e-14	6.91e-11	
Fluoranthene	6.80e-17	3.06e-17	1.87e-16	1.12e-15	1.81e-15	1.81e-15	1.81e-12	
Pyrene	4.01e-17	4.26e-17	1.22e-16	3.79e-16	6.33e-16	6.33e-16	6.33e-13	
Butylbenzylphthalate	2.87e-04	7.09e-02	2.61e-02	2.47e-02	8.87e-03	7.09e-02	7.09e-01	
Benzo(a)anthracene	6.01e-20	6.65e-20	7.32e-19	3.26e-18	2.61e-18	3.26e-18	3.26e-15	
Chrysene	8.50e-21	1.76e-20	2.30e-19	5.06e-19	5.34e-19	5.34e-19	5.34e-16	
bis(2-ethylhexyl)phthalat	1.53e-02	1.67e-01	1.98e-01	2.27e-01	4.23e-02	2.27e-01	2.27e-02	
Di-n-octyl Phthalate		1.25e-03	1.98e-03	1.60e-02	1.27e-03	1.60e-02	1.60e-01	
Benzo(b)fluoranthene		1.43e-18	1.48e-17	1.14e-16	5.90e-17	1.14e-16	1.14e-13	
Benzo(k)fluoranthene		1.45e-18	1.51e-17	1.17e-16	6.01e-17	1.17e-16	1.17e-13	
Benzo(a)pyrene		1.07e-20	2.48e-20	4.60e-19	1.83e-19	4.60e-19	4.60e-16	
Ideno(1,2,3-cd)pyrene			1.54e-22	4.58e-21		4.58e-21	4.58e-18	
Dibenz(a,h)anthracene			3.55e-23	1.50e-21		1.50e-21	1.50e-18	
Benzo(g,h,i)perylene			1.21e-22	6.33e-21	1.37e-21	6.33e-21	6.33e-18	
PESTICIDE/PCB								
alpha-BHC			1.52e-17			1.52e-17	1.52e-14	
beta-BHC			4.85e-19			4.85e-19	4.85e-16	
gamma-BHC (Lindane)		2.64e-07				2.64e-07	2.64e-04	
Aldrin			1.08e-17	3.15e-17		3.15e-17	3.15e-14	
Heptachlor epoxide			3.92e-18			3.92e-18	3.92e-15	
Endosulfan I	5.21e-19	6.15e-17		1.41e-17		6.15e-17	6.15e-14	
4,4'-DDE			5.95e-18			5.95e-18	5.95e-15	
4,4'-DDD			4.79e-18	1.58e-17		1.58e-17	1.58e-14	
4,4'-DDT	1.33e-18	1.37e-15	9.63e-18			1.37e-15	1.37e-12	
Endrin ketone		4.16e-19				4.16e-19	4.16e-16	
Total - PCBs	1.14e-14	1.30e-13	8.21e-14	1.78e-12	2.89e-13	1.78e-12	1.78e-09	
TIC GROUPS								
Propyl Benzenes	1.44e-09	1.60e-08	4.84e-09	3.32e-11	3.29e-08	3.29e-08	3.29e-05	
Propenyl Benzenes		2.82e-09	1.12e-09	8.85e-09		8.85e-09	8.85e-06	
Ethyl Methyl Benzenes	7.91e-09	8.00e-08	5.49e-08	1.02e-07	2.23e-07	2.23e-07	2.23e-04	
Diethyl Benzenes	4.72e-09	5.03e-08	4.80e-08			5.03e-08	5.03e-05	
Methyl Propyl Benzenes	1.01e-10	4.63e-08	8.75e-09		2.48e-08	4.63e-08	4.63e-05	
Methyl Ethenyl Benzenes	1.01e-10				1.11e-08	1.11e-08	1.11e-05	
Methyl Phenyl Benzenes		1.03e-13				1.03e-13	1.03e-10	
Trimethyl Benzenes	8.77e-07	2.37e-06	2.85e-06	1.90e-06	4.11e-06	4.11e-06	4.11e-03	
Dimethyl ethyl benzenes	3.37e-08	1.88e-07	3.71e-08	3.89e-08	4.68e-08	1.88e-07	1.88e-04	
Tetramethyl Benzenes	2.47e-11	1.71e-06	8.44e-08	5.88e-07		1.71e-06	1.71e-03	
Oxygenated Benzenes	6.64e-07	1.49e-07	1.16e-06			1.16e-06	1.16e-03	
Nitrogenated Benzenes		5.66e-10	4.95e-10			5.66e-10	5.66e-07	
Cyclic alkanes	1.97e-07	1.27e-05	4.78e-08	7.45e-07	5.37e-10	1.27e-05	1.27e-02	
Cyclic Alkenes	1.38e-06	2.62e-06	2.27e-07			2.62e-06	2.62e-03	
Halogenated Alkanes	7.71e-09	9.85e-06			2.59e-09	9.85e-06	9.85e-03	
n-chain Alkanes	1.09e-06	4.57e-05	5.71e-07	3.78e-06	3.10e-06	4.57e-05	4.57e-02	
Branched Alkanes	6.11e-07	1.17e-05	1.01e-06	4.17e-06	1.31e-06	1.17e-05	1.17e-02	
Branched Alkenes/Alkynes	2.07e-06	5.16e-06	6.15e-08		2.50e-09	5.16e-06	5.16e-03	
Ethers			1.65e-07			1.65e-07	1.65e-04	
Methylated Naphthalenes	5.66e-14	2.25e-13	6.36e-13			6.36e-13	6.36e-10	

Table V-6

## SUMMARY OF CHEMICAL EXPOSURE POINT CONCENTRATIONS

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Chemical of Potential Concern	----- 500 Meters -----					Maximum Estimated Conc.	Maximum Estimated Conc.
	Onsite Containment Area	Still Bottoms Treatment Lagoon	Offsite Containment Area	Kapica Pazmey Surface	Kapica Pazmey Sub-Surface		
	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(g/m <sup>3</sup> )	(mg/m <sup>3</sup> )
Phthalates		1.56e-13	7.16e-13			7.16e-13	7.16e-10
Methylated Phenols	6.64e-12	2.54e-12	4.22e-11			4.22e-11	4.22e-08
Methylated Ketones		9.33e-09	1.29e-07	6.89e-09	3.36e-10	1.29e-07	1.29e-04
Simple Ketones		1.12e-09	2.92e-10		7.06e-09	7.06e-09	7.06e-06
Cyclic Ketones	5.16e-12	7.79e-10	8.61e-11			7.79e-10	7.79e-07
Diols		3.44e-12	6.59e-10			6.59e-10	6.59e-07
Simple Alcohols	3.17e-13	4.43e-09	8.56e-09		1.16e-11	8.56e-09	8.56e-06
Cyclic Alcohols		2.21e-10	4.23e-11		1.33e-10	2.21e-10	2.21e-07
Oxygenated Alcohols		2.45e-09	4.63e-09			4.63e-09	4.63e-06
Cyclic Acids			2.37e-08	1.72e-07		1.72e-07	1.72e-04
Non-Cyclic Acids	2.49e-08	2.05e-08	9.23e-07	1.13e-07	5.17e-08	9.23e-07	9.23e-04
Amines	4.32e-12	2.08e-12	1.74e-12			4.32e-12	4.32e-09
PCBs	1.05e-14					1.05e-14	1.05e-11
Furans	5.87e-09	1.08e-09	1.68e-10			5.87e-09	5.87e-06

This table contains values calculated in tables V-1 through V-5. Since a receptor at a given point would be exposed to varying amounts from each area, a single value is selected to represent exposure. The maximum emission estimate from the five source areas is selected and converted from g/m<sup>3</sup> to mg/m<sup>3</sup>.

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**Appendix W**

**Modeling of Fugitive Dust Emissions To Determine  
Exposure Point Concentrations**

## Appendix W

### MODELING OF FUGITIVE DUST EMISSIONS TO DETERMINE EXPOSURE POINT CONCENTRATIONS

Fugitive dust emissions are generated from any area with an erodable surface exposed to wind or mechanical disturbances. Mechanical disturbances due to vehicles traveling on unpaved surfaces would not be expected at this Site. Areas effected by wind erosion are identified according to the erodibility of the surface. Most areas at ACS are either fully vegetated or covered with clean gravel, rendering the surface nonerodible. The exception to this is the Kapica-Pazmey area, which overall is unvegetated.

The approach for fugitive dust modeling presented by Cowherd, et al. (1985) incorporates release rate estimation and contaminant migration analysis (dispersion). The method is designed for emergency applications, although the Superfund Exposure Assessment Manual (1988) indicates the degree of accuracy attained using this method is consistent with simplified quantitative estimation methods. To understand the methodologies used to obtain the exposure concentrations for fugitive dust, the guidance provided by Cowherd, et al. (1985) should be referenced. The calculations presented in Table 1 of this appendix are a result of procedures presented in this guidance document.

#### EMISSION RATES

The emission rate of fugitive dust is calculated using the following sequence of equations:

The respirable emission factor  $E_{10}$  is determined for an unlimited reservoir of erodible particles, since the soils present are fine sands, and relates the average annual rate of respirable particles to field and climatic factors in the following equation:

$$E_{10} = 0.036 (1-V) \left( \frac{[u]}{u_t} \right) f(x)$$

where

- $E_{10}$  = PM<sub>10</sub> emission factor (PM<sub>10</sub> - airborne particulate matter with aerodynamic diameter of 10  $\mu$ m or less); i.e., annual average PM<sub>10</sub> emission rate per unit area of contaminated surface ( $g/m^2$  - hr)
- V = fraction of surface covered with vegetation (dimensionless)
- [u] = mean annual wind speed (m/sec)
- f(x) = function plotted in Figure 4-3 (Cowherd, 1985)
- $u_t$  = threshold wind speed at 7 m (m/sec)

Below is a summary of values used for the above parameters to obtain an annual average emission rate:

1. Aggregate size distribution - Soil classification and grain size analysis at the Site indicate the fine sands occur in the greatest amounts. The average particle size mode is 0.1 mm.
2. Threshold friction velocity estimated from figure 3-4 (Cowherd, 1985) is taken to be 25 cm/sec.
3. Using the measure of roughness height ( $z_0$ ) of 5.0 cm (between grasslands and suburban dwellings, as an estimate of the low buildings present as the vegetation outside the immediate area), taken from Figure 3-6 (Cowherd, 1985), the equivalent 7 meter threshold wind speed ( $u_t$ ) is found using Figure 4-1 (Cowherd, 1985) to be:
   
$$u_t = 12.5 (25 \text{ cm/sec}) = 312.5 \text{ cm/sec} = 3.12 \text{ m/sec}$$
4.  $x = 0.886 (3.12 \text{ m/s}) / (4.6 \text{ m/s}) = 1.87$ 
  
The value f(x) is derived from Figure 4-3 (Cowherd, 1985).
   
 $f(0.60) = 1.87$
5. [u] = 4.6 m/s
   
[ $u^+$ ] = 21 m/s (taken from Chicago, IL data, Table 4-1 (Cowherd, 1985))
6. V = 0 (assumes bare soil)

For the ACS Site, the  $E_{10}$  value is  $2.16e-01 \text{ g/m}^2$  - hr. This is the unit emission rate per time of respirable particles.

$$PM_{10} = A E_{10}$$

where

- PM<sub>10</sub> = Annual average emission rate (g/hr)
- A = Source extent (4700  $m^2$ )
- $E_{10}$  = emission factor calculated in previous equation ( $g/m^2$  - hr)

The PM<sub>10</sub> value for the Kapica-Pazmey area at ACS is 1014 g/hr, and represents the emission rate for the the entire area.

$$R_{10} = (PM_{10}) (\alpha)$$

where

R<sub>10</sub> = Emission rate of the contaminant as P<sub>10</sub> particles (g/hr)  
 A = Source extent (4700 m<sup>2</sup>)  
 E<sub>10</sub> = Respirable emissions factor (1.73e-1 g/m<sup>2</sup>-hr)  
 alpha = Mass fraction of specific contaminant in PM<sub>10</sub> emissions (i.e., contamination level in the bulk surface material - maximum concentration)

The R<sub>10</sub> value is the emission rate from the given area for each particular chemical in g/hr.

## DISPERSION MODELING

The emission rates for each compound were used to model atmospheric dispersion concentrations at a specific distance and direction from the contaminant source. The modeling procedure uses previously obtained computer model dispersion output. Specific details may be found in Cowherd, et al. (1985).

Two distances from the source were used in modeling particulate contamination. On-site particulate concentrations were estimated using a distance of 200 meters from the source. Off-site concentrations were obtained for 500 meters from the source. The model does not allow distances to a receptor of less than 200 meters. Wind speed and direction have been factored into the model based on historical meteorological data as described by Cowherd, et al. (1985), thus, concentrations as a function of direction are reflective of the meteorological characteristics of the region.

Below is a summary of calculations and values used to model contaminant dispersion:

1. Climatic region for the Site from Figure 4-5 (Cowherd, 1985) is region 4 and has a P<sub>R</sub> value of 0.288 (Figure 4-7). P<sub>R</sub> represents the fraction of time that wind erosion occurs.

2. Source size required for the model is 100 m x 100 m. (Cowherd, 1985) page 43.
3.  $R_{10}$  results are converted from to ug/s.  
 $(g/hr) (1e + 6 ug/g) / (3600 sec/hr) = ug/sec$
4. Wind erosion scaling factor  $Q_i$   
 $Q_i (ug/sec) = (R_{10} / P_R)$
5. Unscaled Concentration ( $f_j$ ) for Climatic region 4 are taken from Appendix D (Cowherd, 1985) for 200 and 500 meter ranges and 8 directions (N, NE, E, SE, S, SW, W, NW). North provides the most conservative values, and is used to represent fugitive dust emission estimates at the Site.
6. Chronic exposure values,  $x$ , are calculated for each distance and direction

$$Q_i f_j = x (pg/m^3)$$

Respirable concentrations of fugitive dust emanating from the Kapica Pazmey area of the ACS Site are presented in table W-1 of this Appendix.

Table W - 1

## SUMMARY OF FUGITIVE DUST EMISSION AND DISPERSION VALUES

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Compound	--- Emission Rate Calculation ---			----- Dispersion Modeling -----		
	Exposure Point Conc. (ug/kg)	alpha (unitless)	R10 (g/hr)	SCALING FACTORS Q1 = R10/PR (ug/s)	Onsite 200 Meters (mg/m <sup>3</sup> )	Offsite 500 Meters (mg/m <sup>3</sup> )
<b>VOLATILES</b>						
Methylene chloride	2.00e+02	2.00e-07	2.03e-04	1.96e-01	6.70e-10	1.84e-10
Acetone	9.70e+02	9.70e-07	9.84e-04	9.49e-01	3.25e-09	8.92e-10
1,1-Dichloroethane	1.50e+02	1.50e-07	1.52e-04	1.47e-01	5.02e-10	1.38e-10
1,2-Dichloroethene (cis)	7.60e+03	7.60e-06	7.71e-03	7.43e+00	2.55e-08	6.99e-09
Chloroform	1.00e+01	1.00e-08	1.01e-05	9.78e-03	3.35e-11	9.19e-12
1,1,1-Trichloroethane	9.00e+00	9.00e-09	9.13e-06	8.80e-03	3.01e-11	8.27e-12
1,2-Dichloropropane	1.90e+01	1.90e-08	1.93e-05	1.86e-02	6.36e-11	1.75e-11
Trichloroethene	1.70e+05	1.70e-04	1.72e-01	1.66e+02	5.69e-07	1.56e-07
Benzene	3.20e+03	3.20e-06	3.24e-03	3.13e+00	1.07e-08	2.94e-09
4-Methyl-2-pentanone	2.70e+05	2.70e-04	2.74e-01	2.64e+02	9.04e-07	2.48e-07
Tetrachloroethene	7.90e+05	7.90e-04	8.01e-01	7.73e+02	2.65e-06	7.26e-07
Toluene	1.90e+07	1.90e-02	1.93e+01	1.86e+04	6.36e-05	1.75e-05
Chlorobenzene	6.20e+03	6.20e-06	6.29e-03	6.06e+00	2.08e-08	5.70e-09
Ethylbenzene	4.30e+06	4.30e-03	4.36e+00	4.21e+03	1.44e-05	3.95e-06
Styrene	2.30e+04	2.30e-05	2.33e-02	2.25e+01	7.70e-08	2.11e-08
Xylenes (mixed)	2.30e+07	2.30e-02	2.33e+01	2.25e+04	7.70e-05	2.11e-05
<b>SEMIVOLATILES</b>						
Phenol	2.80e+04	2.80e-05	2.84e-02	2.74e+01	9.38e-08	2.57e-08
1,2-Dichlorobenzene	5.90e+02	5.90e-07	5.98e-04	5.77e-01	1.98e-09	5.42e-10
2-Methylphenol	4.70e+03	4.70e-06	4.77e-03	4.60e+00	1.57e-08	4.32e-09
4-Methylphenol	4.60e+03	4.60e-06	4.66e-03	4.50e+00	1.54e-08	4.23e-09
Isophorone	9.70e+04	9.70e-05	9.84e-02	9.49e+01	3.25e-07	8.92e-08
2,4-Dimethylphenol	4.90e+03	4.90e-06	4.97e-03	4.79e+00	1.64e-08	4.50e-09
Naphthalene	9.70e+04	9.70e-05	9.84e-02	9.49e+01	3.25e-07	8.92e-08
2-Methylnaphthalene	5.60e+04	5.60e-05	5.68e-02	5.48e+01	1.88e-07	5.15e-08
2,4,5-Trichlorophenol	1.70e+02	1.70e-07	1.72e-04	1.66e-01	5.69e-10	1.56e-10
Dimethylphthalate	1.40e+03	1.40e-06	1.42e-03	1.37e+00	4.69e-09	1.29e-09
Acenaphthene	3.60e+02	3.60e-07	3.65e-04	3.52e-01	1.21e-09	3.31e-10
Dibenzofuran	4.30e+02	4.30e-07	4.36e-04	4.21e-01	1.44e-09	3.95e-10
Diethylphthalate	5.00e+03	5.00e-06	5.07e-03	4.89e+00	1.67e-08	4.60e-09
Fluorene	6.20e+02	6.20e-07	6.29e-04	6.06e-01	2.08e-09	5.70e-10
N-nitrosodiphenylamine	4.30e+03	4.30e-06	4.36e-03	4.21e+00	1.44e-08	3.95e-09
Pentachlorophenol	1.50e+03	1.50e-06	1.52e-03	1.47e+00	5.02e-09	1.38e-09
Phenanthrene	4.30e+03	4.30e-06	4.36e-03	4.21e+00	1.44e-08	3.95e-09
Anthracene	6.60e+02	6.60e-07	6.69e-04	6.46e-01	2.21e-09	6.07e-10
Di-n-butylphthalate	9.40e+04	9.40e-05	9.53e-02	9.19e+01	3.15e-07	8.64e-08
Fluoranthene	3.40e+03	3.40e-06	3.45e-03	3.33e+00	1.14e-08	3.13e-09
Pyrene	2.30e+03	2.30e-06	2.33e-03	2.25e+00	7.70e-09	2.11e-09
Butylbenzylphthalate	5.10e+04	5.10e-05	5.17e-02	4.99e+01	1.71e-07	4.69e-08
Benzo(a)anthracene	2.40e+03	2.40e-06	2.43e-03	2.35e+00	8.04e-09	2.21e-09

Table W - 1

## SUMMARY OF FUGITIVE DUST EMISSION AND DISPERSION VALUES

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Compound	--- Emission Rate Calculation ---			----- Dispersion Modeling -----		
	Exposure Point Conc.	alpha	R10	SCALING FACTORS	Onsite	Offsite
	(ug/kg)	(unitless)	(g/hr)	Q1 = R10/PR (ug/s)	200 Meters (mg/m3)	500 Meters (mg/m3)
Chrysene	1.30e+03	1.30e-06	1.32e-03	1.27e+00	4.35e-09	1.20e-09
bis(2-ethylhexyl)phthalate	5.40e+05	5.40e-04	5.48e-01	5.28e+02	1.81e-06	4.96e-07
Di-n-octyl Phthalate	3.80e+04	3.80e-05	3.85e-02	3.72e+01	1.27e-07	3.49e-08
Benzo(b)fluoranthene	3.90e+03	3.90e-06	3.95e-03	3.81e+00	1.31e-08	3.59e-09
Benzo(k)fluoranthene	3.90e+03	3.90e-06	3.95e-03	3.81e+00	1.31e-08	3.59e-09
Benzo(a)pyrene	1.40e+03	1.40e-06	1.42e-03	1.37e+00	4.69e-09	1.29e-09
Ideno(1,2,3-cd)pyrene	8.20e+02	8.20e-07	8.32e-04	8.02e-01	2.75e-09	7.54e-10
Dibenz(a,h)anthracene	2.70e+02	2.70e-07	2.74e-04	2.64e-01	9.04e-10	2.48e-10
Benzo(g,h,i)perylene	1.10e+03	1.10e-06	1.12e-03	1.08e+00	3.68e-09	1.01e-09
PESTICIDE/PCB						
Aldrin	8.80e+01	8.80e-08	8.92e-05	8.61e-02	2.95e-10	8.09e-11
Endosulfan I	4.20e+01	4.20e-08	4.26e-05	4.11e-02	1.41e-10	3.86e-11
4,4'-DDD	1.50e+02	1.50e-07	1.52e-04	1.47e-01	5.02e-10	1.38e-10
Total - PCBs	3.29e+05	3.29e-04	3.34e-01	3.22e+02	1.10e-06	3.02e-07
METALS						
Aluminum	1.32e+04	1.32e-05	1.34e-02	1.29e+01	4.42e-08	1.21e-08
Antimony	8.48e+01	8.48e-08	8.60e-05	8.29e-02	2.84e-10	7.80e-11
Barium	5.73e+03	5.73e-06	5.81e-03	5.60e+00	1.92e-08	5.27e-09
Cadmium (food/soil)	1.74e+02	1.74e-07	1.76e-04	1.70e-01	5.83e-10	1.60e-10
Calcium	1.57e+05	1.57e-04	1.59e-01	1.54e+02	5.26e-07	1.44e-07
Chromium IV	3.08e+03	3.08e-06	3.12e-03	3.01e+00	1.03e-08	2.83e-09
Cobalt	1.48e+02	1.48e-07	1.50e-04	1.45e-01	4.96e-10	1.36e-10
Copper	4.47e+03	4.47e-06	4.53e-03	4.37e+00	1.50e-08	4.11e-09
Iron	7.01e+04	7.01e-05	7.11e-02	6.86e+01	2.35e-07	6.44e-08
Lead	1.62e+04	1.62e-05	1.64e-02	1.58e+01	5.43e-08	1.49e-08
Magnesium	3.69e+04	3.69e-05	3.74e-02	3.61e+01	1.24e-07	3.39e-08
Manganese	1.54e+03	1.54e-06	1.56e-03	1.51e+00	5.16e-09	1.42e-09
Mercury	9.50e+00	9.50e-09	9.63e-06	9.29e-03	3.18e-11	8.73e-12
Nickel	1.97e+02	1.97e-07	2.00e-04	1.93e-01	6.60e-10	1.81e-10
Selenium	1.72e+01	1.72e-08	1.74e-05	1.68e-02	5.76e-11	1.58e-11
Silver	2.48e+01	2.48e-08	2.51e-05	2.43e-02	8.31e-11	2.28e-11
Vanadium	4.77e+01	4.77e-08	4.84e-05	4.67e-02	1.60e-10	4.39e-11
Zinc	1.58e+04	1.58e-05	1.60e-02	1.55e+01	5.29e-08	1.45e-08
Cyanide	6.62e+01	6.62e-08	6.71e-05	6.47e-02	2.22e-10	6.09e-11
Propyl Benzenes	1.20e+02	1.20e-07	1.22e-04	1.17e-01	4.02e-10	1.10e-10
Propenyl Benzenes	3.20e+04	3.20e-05	3.24e-02	3.13e+01	1.07e-07	2.94e-08
Ethyl Methyl Benzenes	3.70e+05	3.70e-04	3.75e-01	3.62e+02	1.24e-06	3.40e-07
Trimethyl Benzenes	2.20e+05	2.20e-04	2.23e-01	2.15e+02	7.37e-07	2.02e-07
Dimethyl ethyl benzenes	6.00e+04	6.00e-05	6.08e-02	5.87e+01	2.01e-07	5.52e-08
Tetramethyl Benzenes	6.80e+04	6.80e-05	6.90e-02	6.65e+01	2.28e-07	6.25e-08

Table W - 1

SUMMARY OF FUGITIVE DUST EMISSION AND DISPERSION VALUES

American Chemical Services NPL Site  
Remedial Investigation  
Griffith, Indiana

Compound	--- Emission Rate Calculation ---			----- Dispersion Modeling -----		
	Exposure Point Conc.	alpha	R10	SCALING FACTORS	Onsite	Offsite
	(ug/kg)	(unitless)	(g/hr)	Q1 = R10/PR (ug/s)	200 Meters (mg/m3)	500 Meters (mg/m3)
Cyclic alkanes	5.20e+04	5.20e-05	5.27e-02	5.09e+01	1.74e-07	4.78e-08
n-chain Alkanes	2.90e+05	2.90e-04	2.94e-01	2.84e+02	9.71e-07	2.67e-07
Branched Alkanes	3.20e+05	3.20e-04	3.24e-01	3.13e+02	1.07e-06	2.94e-07
Methylated Ketones	1.80e+02	1.80e-07	1.83e-04	1.76e-01	6.03e-10	1.65e-10
Cyclic Acids	1.90e+04	1.90e-05	1.93e-02	1.86e+01	6.36e-08	1.75e-08
Non-Cyclic Acids	2.60e+05	2.60e-04	2.64e-01	2.54e+02	8.71e-07	2.39e-07

$R10 = PM10 * alpha$

$E10 = 0.036 (1-V) ([U]/Ut)^3 F(x)$

Scaling Factor Q1 = (R10 / PR) \* ((1e+06 ug/g) / (hr/3600

where  
 $PM10 = E10 * A$

where  
V = 0  
[U] = 4.6 (m/sec)  
Ut = 3.12  
F(x) = 1.87

Chronic Exposure Value X (pg/m3) = Q1 \* F1  
mg/m3 = (pg/m3)\*1.0e-9

A = 4.70e+03 m2  
E10 = 2.16e-01 g/m2-hr  
alpha org = [Max(ug/kg)/1e+09]  
alpha inorg = [Max(mg/kg)/1e+06]

PR value from Figure 4-7, Cowherd et al. 1985  
Climatic Region = 4 PR = 0.288

F1 values from page D-17, Cowherd et al. 1985  
F1 for North at 200 Meters = 3.425  
F1 for North at 500 Meters = 0.941

This table provides values calculated using the procedures outlined in "Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites", Cowherd et. al., February 1985 (EPA/600/8-85/002)

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